Maximizing the Utilization of Low Value or Small-Size Fish for Human Consumption by Improving Food Safety and Value Added Product Development (Fermented Fish Paste) Through the Promotion of Women's Fish Processing Groups/Associations in Cambodia

Food Safety and Value-Added Product Development/Study/09FSV01UC

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ABSTRACT

The fisheries resources in the Cambodia are faced with drastic decline due to the rapid increase in population and illegal fishing activities; many captured fisheries resources have been largely overexploited, as well as the increasing competition and conflict between the use of low value/trash fish for feeding and human consumption; and most traditional fisheries production is more focused on fermented fish paste that is very commonly consumed especially by the rural/very poor people.

The project entitled "Maximizing the Utilization of Low Values or Small-Size Fish for Human Consumption through Improving Food Safety and Value Added Product Development: Fermented Fish Paste/*PRAHOC* through the Promotion of Fish Processing Women Group/Association in Cambodia" is aimed at improving the Cambodian's food safety, profitability in competitive market with other international neighboring countries, and maintaining our fermented fish paste/*PRAHOC* brand name, its value and its marketing. This project also helps support the Cambodian women that are involved in the processing chain from farm to table - it means that everyone from processors to traders, consumers, competent authority they can perform their functions effectively. So they really play very important roles and can generate their income from this by applying standards and codes of practice that can lead the women towards having a voice, which is traditionally limited in the Cambodian culture.

However, the effectiveness and efficiency of this project also relies on the help of government and private producers, NGOs, researchers, policy makers, and other involved stakeholders who can perform their roles well together in order to improve and ensure fish and fisheries/food quality, hygienic food safety in Cambodia for all consumers. But in this project, we do not have enough time to ensure the effectiveness and efficiency of our Fermented Fish Paste/*PRAHOC* Technology Development, GMP/GHP Code of Practice and Product Standard Development in conducting trials or experiments, and involving, throughout this fermented fish paste processing, the women groups and finalizing these standards and practice codes on the national level. As we already know, Cambodians already have their set ways of producing so it is difficult for us to apply and disseminate all of this information, to educate and to communicate to them with the utmost impact over a short duration. But if our government and policy-makers can give more priority to improving, ensuring and mandating food safety standards together with the private sector and other public sectors with some financial and technical support too. Then, maybe, we can achieve it in a very short time.

INTRODUCTION

1. In Cambodia, low value/trash fish is used for human consumption, particularly by the poor as it is relatively cheap and provides good sources of protein and other nutrients to humans, especially pregnant women and children. The fish is utilized for household food security and income. Artisanal processing is undertaken to make fermented fish or fish paste (*PRAHOC* in the Khmer language) or processed in other ways (e.g. fish sauce, *teuk trei* in the Khmer language) using different traditional processing practices. This processing is done primarily by women. This processed product is used in the household and sold in local and regional markets (Thailand, Laos, and Vietnam) and provides income to the household. Tens of thousands of the Cambodia poor, especially rice farmers, who are living hundreds of kilometers away from the main natural freshwater water bodies, come to the *Tonle Sap* River during December to February every year to buy low value or small-sized fish to make *PRAHOC*. Vietnamese traders are known to come to Cambodia to purchase both fresh and semi-processed low value/trash fish for further value-added processing in Vietnam. The increasing competition for low value/trash fish for aquaculture has reduced the supply of fish for these value-added products. *PRAHOC* is produced in a variety of ways depending on the raw material, but there are two main types: boneless and bony. Boneless *PRAHOC* is made almost exclusively from *gourami* species and commands a high price in the restaurant trade, for export and amongst higher income consumers. *PRAHOC* made from small mixed species is less valuable but is a more universally made product from the messes of small fish caught in the *dai* fisheries or from other miscellaneous fish caught at other times of the year. It is produced essentially by taking fresh fish and removing the heads and scales and intestines. The fish are salted and dried for a few days before being mixed with salt and stored in airtight ceramic vats to mature. The products are made by subsistence fishermen and others when fish are abundant as a means of storage for later consumption or as a product for sale or barter for other food stuffs.

2. *PRAHOC* is perhaps the most widely consumed fish paste, but the quality of this product varies and has a short shelf-life with a number of health concerns associated with this. Due to lack of standards for most of the products and lack of inspections and controls, there is significant value loss. There are no official control services available at central level and in provinces for products intended for domestic consumption, consequent to which, health control and monitoring of production conditions are not in place at any stage of the fish production chain. The official laboratories are not in a position to perform the range of analysis required for quality checks. Health conditions during production and storage of fishery products are not in line with the requirements and fish-borne illnesses are recognized as an important public health problem. So far, there are few regulations and standards related to fish and fish products. The shortage of standards addressing fish, food additives and fish-feed hinders action against adulterated or contaminated food. Overcoming this would be important for achieving the goal of protecting the people against fish borne diseases (UNDSF-8; NSDP-4.45/4).

3. According to the results of gender implications in the study conducted by the CBCRM Learning Center in Cambodia, "The Role, Needs, and Aspiration of Women in the Community Fisheries in Cambodia", in six fishing communities: "the main roles of women in fisheries-related livelihood activities, the results from most of the case studies are consistent with the general understanding from the literature review. This is that women are engaged in a variety of fisheries-related livelihood activities on their own small-scale capture fisheries, gathering of aquatic plants and animals, aquaculture - and also play a supportive role in the fishing activities of their husbands. But the main responsibility of women in fisheries-related livelihoods is in the post-harvest sector, including processing and trading fish." (Keang Seng 2001; Khim et al. 2002; IFM 2007). In all study sites, women are viewed as more competent than men in marketing fish and take more responsibility in the post-harvest stage of fisheries livelihoods. In some cases, men immediately

sell the fish to collectors at landing sites. Women think of this as a disadvantage because men do not usually negotiate prices or look for the best buyer and thus may not get a good price for their catch. Women's roles in fisheries are often invisible because fisheries management normally focuses only until catch and does not take the post-harvest stage into consideration. It is noted that women play a large role in the post-harvest stage, and it would not be an exaggeration to say that the need created in the post-harvest stage is largely determined by the effort for catch. Many studies described women's roles in every aspect of rural livelihoods in Cambodia, including some documentation on the traditional division of labor between men and women in agriculture. However, there has been little examination on women's roles and contribution to fisheries post-harvest sector. Understanding gender in the development of fisheries post-harvest is very important especially for their participation and contribution to improve their livelihood and food quality, safety, and food nutrition in order for the sustainable development and management of fisheries natural resources. It can also help to improve women's rights and participation in the socio-economic activities. The results of work undertaken in Phase-I (*Implementation Plan 2007–2009*) show that hygienic and quality of *PRAHOC* are the main driven factors for local and external demands. The study also showed that semi-processed products of small-size fish are also important for external markets (e.g. Thailand and Vietnam). So hygienic and quality issues should be addressed in the second phase of the project. The study of Phase-I also documented traditional and modern *PRAHOC* processing technologies, and compared the two in order to develop Best Practices for producing *PRAHOC*. For phase-II (*Implementation Plan 2009–2011)*, we will use this output on best practice for *PRAHOC* processing method to develop the *PRAHOC* quality and safety guidelines, standardized packaging and labeling for fish paste and apply to promote the women fish processing group/association. So based on this investigation we hope that we will have a direct and indirect effect/impact to the National Fisheries Post-Harvest Sector. The results can be used to effectively enhance human health to all consumers and processors of the fish paste in order to promote the alternative livelihood/employment of the people who depend on the fisheries, especially women in the community fisheries members/fishers/processors in order to increase their income. These activities will also help to improve women's sharing of the added value and improve the social/family economic livelihoods, and equal rights in family decision-making as many of Cambodian women have low education.

METHODOLOGY

This investigation is a study which was comprised of the following activities:

- **The Literature review of the result** from first phase with a desktop survey to better understand fermented fish paste processing practices in Cambodia and fermented fish processing quality standard guidelines and also review of the international standard from *Codex Alimentarius* in order to standardize the code of practice/guidelines to approve not only for national use but also for international acceptance;

- **Field observation, focus group discussion, and key informant interview observation** using some guide questions to the processors to study processing practices on the processing plant/chain and areas of fermented fish paste product and to identify problems and issues related to food safety, processing, and value-added product development.

- **Identify and analyze the composition and natural and chemical hazard of the products** by getting samples from the site and then sending to the accreditation laboratory to check and analyze it. As we already know, *PRAHOC* is very uniqueness and traditional fisheries product and food for Cambodian people and some Asian people like very much to consume it and no

international standard or guideline/GMP/GHP code of practice has been done or developed yet. So all the parameters are the basic criteria that we need to develop and identified by our self for the product standard and in order to identify an effectiveness of this product standard we need to test and analyze all of these parameters. So these result of these samples we can limit the amount of every parameters that should have how much amount as minimum and maximum in the product standard and for some parameters that not include in the testing and analyzing, we just are adopted from the international *Codex Alimentarius* that they already internationalize used it.

There has been testing and analysis of all parameters of all the composition and natural and chemical hazard of the *PRAHOC* products (Appendix I). Four samples (one each from small scale, medium scale, and large scale producers, and public markets with two types of *Prahoc* (boney and boneless) from nine provinces (Kampong Chnnang, Pursat, Battambang, Siem Reap, Kampong Thom, Kampong Cham, Kraties, Kampong Som, Takeo, Kandal) and five samples from public markets and department store in Phnom Penh. Testing and analysis were done for original baseline before applying the *PRAHOC* best practice GMP/GHP code of practices and product standard draft and the second testing was after applying the *PRAHOC* best practice for GMP/GHP code of practice and product standard to the trial women groups in Siem Reap Province and some family processors. This was done through a consultation workshop process of this standard development and awareness building and by mass media (TV, Radio, and FiA magazine) to all the same parameters, samples size, and samples locations.

- Conducted many consultation workshop/meetings with processors, who are primarily women, and representatives from Department of Fisheries Post-Harvest Technology and Quality, Department of Aquaculture Development, Department of Fisheries Administration and Litigation of Fisheries Administration (FiA); other relevant agencies involving in food safety and legal framework such as Department of Agriculture Legislation, Department of Agriculture Industry of Ministry of Agriculture, Forestry, and Fisheries (MAFF); Department of Food and Drug, and Department of Legislation of Ministry of Health (MoH); Department of CAMCONTROL of Ministry of Commerce (MOC); Department of Legislation and Institute of Standard of Cambodia (ISC) of Ministry of Industry, Mine, and Energy (MIME), on the best practice of fermented fish paste product quality standard and safety guideline, packaging and labeling. (Refers to the Photo 14, 15 &16).

- Quality method will be employed in analyzing data and developing the guidelines, standardized packaging and labeling of *PRAHOC* product that will assist with analyses by Dr. Chong Lee, a Food Scientist of the University of Rhode Island, USA and some expert from FAO, Rome, Italy too.

- Outreach to promote the women fermented fish paste processing group/association and apply the best practice quality safety guidelines, standardized packaging and labeling to improve the product quality, safety, values added, and competitive market to women processors.

- Publishing and disseminating the best practices for quality and safety guidelines, packaging, and labeling standards of the fermented fish paste product to processors and provincial fisheries officers through research reports or guideline book, newspaper/ magazine article, TV/radio. The publications (Appendices II and III) will be translated into the local Khmer language.

RESULTS

The main objective of the investigation is to work with women to improve and ensure food safety and values added of fermented fish paste product for local consumers and the competitive markets in

Cambodia, and the development of women fish processing group/association through the development, application and dissemination for national use and involving other stakeholders in the processing chain of the Product Technology Development, GMP/GHP Code of Practice and Product Standard Development from the result of the project study. The Investigation IV (09FSV01UC) was implemented and achieved the following results:

1. **Institutional Capacity Building:**
   - ✓ Developed a finalized set of the fermented fish paste guideline and standard on the Product Technology Development, Good Manufacturing Practice (GMP) and Good Hygienic Practice (GHP) Code of Practice and Product Standard Development for generalize use at the national level through many consultation workshops, meetings with the fermented processors, traders, fisheries authorities, standard developer from the Institute of Standard of Cambodia (ISC) of Ministry of Industry, Mine and Energy (MIME) and some experts such as Dr. Chong Lee, a Food Scientist of the University of Rhode Island, USA and many more from the FAO in Rome, Italy with other relevant agencies such as Ministries of Agriculture, Department of Food and Drug of Ministry of Health (MOH), Directorate Department of CAMCONTROL of Ministry of Commerce (MOC).

   - ✓ Developed a trial women processor group/association in *Siem Reap* province in order to improve and enhance the fermented fish paste product with the new finalized draft development of the best Product Technology Development, GMP/GHP Code of Practice, and Product Standard Development in consultation with and guide of many stakeholders and experts.

   - ✓ Conducted two trainings to build the capacity of the Research Team Members and the Fisheries Officers from the Central and Provincial of Fisheries Administration together with the Fermented Fish Processors on the General GMP/GHP Code of Practice for fish and fisheries products as a basic concept to improve and ensure the fish and fisheries products quality, safety and values added in Cambodia.

2. **Awareness Raising and Standard/Code of Practice/Guideline Transfer:**
   - **a. Awareness Raising:** carried out public awareness activities in the form of Inception Workshop, Consultation Workshop, and Dissemination Workshop/ training, and Information Education and Communication (IEC) materials and disseminate all activities of the project through the National Mass media (TV and Ratio) and also the National Fisheries Administration and Ministry of Agriculture Forestry and Fisheries Magazines too.

     - **Inception Workshop:** Introduced this Project Investigation IV within the Inception Workshop of the whole AquaFish CRSP Project activities at IFReDI to provide awareness with more than 40 participants of both national and provincial government fisheries officers, NGOs representatives, local communities, and other relevant stakeholders participated. The workshop aimed to provide awareness and hold consultation among the participants, particularly the stakeholders whose work related to aquaculture and post-harvest fisheries quality and safety development sector as well as to receive their suggestions and recommendations.

     - **Consultation Workshop:** Conducted the workshop and meeting to consult with the fermented processors, traders, fisheries officers, local authorities, other relevant agencies involved in the food quality and safety such as from the department of agriculture industry, department of agriculture legislation, and other representative of Ministry of Agriculture Forestry and Fisheries; Institute of Standard of Cambodia (ISC) of Ministry

of Industry, Mine, and Energy (MIME); Directorate Department of CAMCONTROL of Ministry of Commerce (MOC); Department of Food and Drug of Ministry of Health (MOH), and other national and international experts with the workshop aim being to conduct awareness and consultation on the Fermented Fish Paste (PRAHOC) Technology Development, GMP/GHP Code of Practice, and Product Standard Development and disseminate through national TV, radio, and magazines.

- **Dissemination Workshop:** Organized the workshop to disseminate the research results of Investigation IV to about 100 participants - processors, traders, local authorities, Central and Provincial Fisheries Officers, researchers, NGOs, and other relevant agencies involved in food quality and safety, and representatives from local community fisheries in all the provinces in Cambodia. The workshop provided awareness-raising on the important role of fermented fish paste/*PRAHOC* quality, hygienic and safety and values added for promoting market of this product, that every Cambodian people and any other neighbor people that also consume this kind of fermented fish paste as a ingredient and food for every days in daily protein intake of local people.

- **Impact Observation on Fermented Fish Paste/*PRAHOC*:** After two years with the project, we can now see the Cambodian people, and not only the *PRAHOC* processors and traders and consumers, also start to care about the food quality, hygienic and safety of their product. Even those from the fisheries administration and Ministry of Agriculture management level also better understand and consider more, compared to before this project implementation when the only concern was about the basic need to fill stomachs and not about food quality, hygienic, and safety. And for some time even the women processing group was already applying and trying these best standards and codes of practice before the finalized draft was submitted to the Ministry of Agriculture Forestry and Fisheries and Institute of Standard of Cambodia for their approval and acceptance as the national standard after the trial of this pilot with this women group. In 2010, the One Village, One Product of the Royal Government of Cambodia had conducted an exhibition of their products that the Fisheries Product is one of their products too.

3. **Institutional Research Collaboration:** This project "Development of Alternative to the Use of Freshwater Low Value Fish for Aquaculture in the Lower Mekong Basin Cambodia and Vietnam: Implications for Livelihoods, Production and Markets" provided opportunities for international travels to participate in international conferences and workshop which this opportunity was not only enhanced institutional and staff capability but also established networking and linkages between and among the research institutes, universities, and development institutions around the world.

DISCUSSION

The main goal of this investigation is for improving and ensuring food safety and values added of fermented fish paste product for local Cambodian consumers and the competitive market in Cambodia with the development of women fermented fish paste processing group/ association. These main goals take into account that the main driver of this project is the continued improvement and ensuring of our Cambodian traditional fisheries product food that everyone needs to eat everyday especially with the rural people who are more dependent on the fermented fish paste/*PRAHOC* for their food, and every year during the fishing peak season, every Cambodian needs to produce a hundred kilograms of *PRAHOC* to keep at home as food. They have their own technology in processing but they do not really nor care much about the hygienic and safe process and this may affect their health.

It also takes into account that: the fisheries food hygienic and safety can continue to play an important role in the food security, poverty alleviation and economies of our countries; the strong interdependency on our *PRAHOC* and raw material resources and also can increase local and intra-regional trade for low value/trash fish products; and there is increasing competition and conflict between the use of low values added to the product and lead to develop a policy and intervention on the fisheries product food safety.

The Investigation IV in the first phase of this project, the fermented fish processing method was not consulted well with the stakeholder and it has some mistakes and the definition of terms is not really professional and scientific term to use. For the second phase of this investigation, we can have proper and standardized format to develop of the Processing Technology, GMP/GHP Code of Practice (Appendix II) and Product Standard (Appendix III) used to improve their hygienic, safety and values added of the product throughout the trial and applied by the women *PRAHOC* processing association/group to see the effectiveness and efficiency of this standard and code of practice that we already drafted and what level our processors, traders, and fisheries officers can adapt and practically benefit from it and consume. So the new AquaFish fermented fish paste/*PRAHOC* Technology Development, GMP/GHP Code of Practice, and Product Standard Development need more time to thoroughly test and conduct more experiments of this standard and code of practice and finally result in the maximization of its level of effectiveness and efficiency before submitting it to MAFF, ISC and *Codex Alimentarius* for their approval as the national standard.

CONCLUSION

The project addressed a critical gap in terms of institutional capability of Fisheries Administration, especially to the Department of Fisheries Post-Harvest Technology and Quality which were not really considered and have ability to improving and ensure the quality, safety, and values added of the fish and fisheries products yet in term of the rules, regulation and standard, guidelines and code of practice and together with intervention to all stakeholders in the processing chain from farm to table due to lack of human resources and financial support that affect their implementation leading to problems on food security and profitability. The project has built up not only institutional and staff capacity but also established networking and linkages between and among the research institutes, universities, and development institutions around the world.

The project addressed the urgent need to solve the food security, safety and competitive market of fisheries products in fisheries sector in Cambodia with the formal national fermented fish paste/*PRAHOC* Technology Development, GMP/GHP Code of Practice and Product Standard Development and more than a 100 scientists, researchers, government fisheries managers and policy-makers, inter-government and non-government staff, extension agents, academic institutions, private sector, importer and exporters, fish farmers, fishers, fish traders, fish processors, and consumers can have a better understanding and use of *PRAHOC* processing better with the best practice standards and code of practice to improve the quality and safety, values added for this product and market opportunities. 2000 poor households in Cambodia, including women, who rely on fermented fish paste processed products will have improvements in product quality and safety and also 2000 poor households in Cambodia, including women members of the households who process low value/trash fish, will be better informed about potential improvements in processing practice; values added product development opportunities; and market opportunities toward increasing their income. On the other hand, this investigation can give long-term direct impact on at least a million of people who will benefit from eating healthy fermented fish paste food across the country in support of national poverty alleviation and increasing the fishing pressure in order to sustain the natural resources management and development.

LESSONS LEARNED IN IMPROVING FOOD SAFETY AND VALUE ADDED PRODUCT DEVELOPMENT FOR *PRAHOC* (FERMENTED FISH PASTE) IN CAMBODIA.

A number of lessons learned will be reported from the investigation – Maximizing the utilization of low-value or small-size fish for human consumption through improving food safety and value-added product development (fermented fish paste) through the promotion of fish processing women's groups/associations in Cambodia. The overall objective of this investigation was to work with women to improve and ensure food safety and value-added fermented fish paste products for local consumers, the competitive markets in Cambodia, and the development of women fish processing groups/associations through the development and extension of the fermented fish paste technology development; Good Manufacturing Practice (GMP)/Good Hygienic Practice (GHP) Code of Practice; and fermented fish paste product standard to apply to adopt and meet national and international market requirements. The location of the activities was *Siem Reap* Province.

An important lesson learned was the difficulty in obtaining approval at national and international levels for the *PRAHOC* standards. In the approval process, there is the need for approval from the Minister of the Ministry of Agriculture, Forestry, and Fisheries (MAFF); the President of the Institute of Standard Cambodia (ISC); the Ministry of Industry, Mines, and Energy (MIME); and the International *Codex Alimentarius* Union. Currently, we are waiting for the MAFF Minister's approval. During the process of the development of these standards, at every meeting and consultation there were a lot of comments which provided many ways to develop the standards for only the national market. But some participants stated that we must develop the standards to meet the international market requirements because every year our *PRAHOC* is exported to the neighboring countries, especially Thailand. In Thailand, the *PRAHOC* is reprocessed, packaged and labeled with the brand name of *PRAHOC Siem Reap Province,* but labeled as "Made in Thailand". It is felt that the value added for the product is lost to the Cambodian people. Due to these reasons, the MAFF leaders decided to develop the standards for the *PRAHOC* product that can be accepted by both national and international markets. But it is taking time to get approvals from the MAFF Minister and also the ISC president and EU *Codex Alimentarius*.

During the development of the product standards, we also applied these best processing practices through the women *PRAHOC* processor groups/associations in order to try and test the effectiveness and efficiency of the standards. During the *PRAHOC* sample testing, we found out that some samples are very unsafe for human consumption due to poor processing and preserving/maintaining conditions along the value chain. The Cambodian people do not seem to care about food safety and they care only about how to fill their stomachs. So it is very difficult for the government authorities, especially the Fisheries Administration, to require standards. During the organizing of the women *PRAHOC* processor group/association, people were not willing to participate in the group/association, and no one was willing to apply the standards. They stated that why do they need to participate as it is a waste of money and we spend much time for what reason? The processors do not follow any standard or apply any GMP/GHP code of practice, but they still cannot meet the demand of their buyers or consumers. These issues are raised not only by the processors, but also with people at the government management level, as they don't know and consider much and also understand about the side effects and hazards from the fisheries product food safety that we did not do it in the proper ways. The project worked to convince the processors about the importance of food safety, especially in fisheries products, through conducting trainings on critical hazards in the fisheries products and production. It also conducted monthly meetings with our fisheries administration in order to involve them in fisheries food safety activities. The project also developed some programs related to food safety in fisheries through broadcast mass media such as national TV and radio. There is now a slow development to better understanding and support of the need for food safety issues and best practices on *PRAHOC* processing standards development.

There are several other conclusions and lesson learned from this investigation on improving the food safety and value added product development of *PRAHOC* through the promotion of fish processing women group/association in Cambodia:

- At present in a poor country like Cambodia the people's perspective is on basic needs and there is limited concern about food safety standards.
- In Cambodia the management system are very complicated of bureaucracy system to follow and have their-own belief and trust that lead to have some issue on the delay result of the project outputs.
- The Cambodian people are still limited in their knowledge and awareness about food safety, especially from fisheries product and production
- The project has been able to begin to develop greater understanding from government, processors, consumers and other stakeholders on food safety issues and the need for food safety standards and best practice. Some even ask when can we finalize and approve the standards from the MAFF Minister and ISC president.
- In order to maintain the effectiveness and efficiency of the project funding, support should be best ways needed to integrate and harmonize with our 10 years Fisheries Administration Strategic Plan for next step activities.
- In order to finalize the best practice and standards we need to collaborate and integrate with other projects, such as The Promotion of One Village, One Fisheries Product (FOVOP). This project already has a brand name and it fully understood by everyone. The development of the *PRAHOC* standard should be understood as being one special and unique fisheries product which is certified as to product quality and safety with the FOVOP Logo and Stamp of approval and marketed through the National One Village One Product (OVOP) chair by Prime Minister Hun Sen.
- To be more successful we should have some cooperation and collaboration with a university for student research and sharing of expertise, technology and equipment.

It is suggested to continue future action and implementation of this work in order to finalize the best practice for *PRAHOC* technology development, GMP/GHP code of practice, and product standards development through conducting research experiments and trials to find the most effective and efficient standard for the national and international markets. To be more effective, the project should obtain more support in actual demonstration through the whole processing chain to make sure that everyone can see a real benefit with their own eyes. The best practice and standards can benefit Cambodians with safe fish food products to alleviate poverty, increase the economic contribution from fisheries products and production, and Cambodia can maintain their brand name of their unique products.

QUANTIFIABLE ANTICIPATED BENEFIT STATEMENT

This investigation will provide direct and indirect benefit stakeholders such as: the target beneficiaries are the fish processors and fish traders, who are primarily women, who would get better price for their improved quality of the product, and fermented fish paste consumers, who will get a safer product, and would be able to access better markets having complied with quality and safety requirements of these markets. The impact of the project will benefit the entire fisheries sector by improving the livelihoods of Inland and coastal fishing communities, and the women in those communities, generating better products through improved processing and packaging labeling techniques, facilitating access to new markets.

One student was supported and involved in the project through thesis research, but in this project we are not lucky enough to get student thesis because our student passed away in January 2011 after the USAID team came to Cambodia for their Monitoring and Evaluation work.

The National Fisheries Post-Harvest Sector will have formal national standard and code of practice and guideline on Fermented Fish Paste on Product development technology development, GMP/GHP Code of Practice, and Product Standard Development that finalized and approved by MAFF, ISC and future plan approve by the International *Codex Alimentarius* used to control product quality, safety, values added and marketing and can serve as a road map for future management and development.

A total of 100 scientists, researchers, government fisheries managers and policy-makers, inter-government and non-government staff, extension agents, academic institutions, private sector, importer and exporters, fish farmers, fishers, fish traders, fish processors, and consumers will have a better understanding and use of *Prahoc* processing better with the best practices guidelines to improve quality and safety, values added for this product and market opportunities.

A total of more than 2000 poor households in Cambodia, including women, who rely on fermented fish paste processed products, have improved knowledge and practices in product quality and safety, and help to extend more of this important advantage to many processors and consumers in Cambodia.

2000 poor households in Cambodia, including women members of the households who process low value/trash fish, are better informed about potential improvements in processing practices, value-added product development opportunities, and market opportunities toward increasing their income.

Nowadays, Cambodia can get many benefits that we could not quantify or imagine from this - project support from USAID as direct and indirect impact in terms of soft- and hardware to help our country especially the national government as we still seek government support, and many millions of Cambodians' awareness and understanding about food safety especially. *PRAHOC* is a very traditional food and ingredient especially for the rural people. More than 80% of the total population, and even our management level people too, all know the impact on their health of consuming and producing unsafe and unhygienic *PRAHOC* products. This knowledge and understanding can help them add value and get more income from safe and hygienic practices and can contribute to alleviate poverty and help the sustainability of our natural resources especially for fisheries resources management, conservation and development, even with being confronted by climate change that is a global warning too just, through national (TV, radio) media mass broadcast of all events/activities relating to this project support during the development of this *PRAHOC* standard and guideline process such as conducting consultation workshops, trainings, meetings with the stakeholders.

So I can conclude that after this 2-year project I can observe that our country has many long-term and short-term benefits such as: all national to sub-national government management levels have more awareness and understanding and coordinated application and assignment of priority to it when they consider it as a national policy; and stakeholders in the processing chain from farm to fork now also begin to be aware and have understanding about applying all concerns about the hygienic and food safety issues together with the values added to increase their income and also concern about *PRAHOC,* our traditional produc that every year we export thousands of tons of the semi-final *PRAHOC* product to Thailand for packaging to meet the international standard but get labeled as **"Prahoc Siem Reap**[1] *but* **Made in Thailand".** So with this project, we hope we can get back our brand name from Thailand and we can finish the product ourselves and then export this final product and realize higher profits from applying these high standards and guidelines.

[1] Siem Reap is one province in the very popular Angkor Wat Temple area, which makes for a very good brand name as "Prahoc Siem Reap". "Prahoc made in Siem Reap" will impress a consumer that the product will be delicious and can command a very high price.

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Also very special thanks to H.E. Ping Siv Lay, President/Director general of Institute of Standard of Cambodia, and his colleagues for their support, guidance, and help in the further approval of our finalized draft on Fermented Fish Paste/*PRAHOC* Technology Development, GMP/GHP Code of Practice and Product Standard Development for the national standardized use of Cambodia.

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Finally, the author would like to delicate this work this work to the respondents, *PRAHOC* processors, traders, fishermen, fisheries communities, and local authorities in Cambodia who made time out of their busy schedules for the interview.

This investigation will provide direct and indirect benefits to stakeholders such as: the target beneficiaries are the fish processors and fish traders, who are primarily women, who would get better prices for the improved quality of the product; fermented fish paste consumers who will get a safer product; and better market access having complied with quality and safety requirements of these markets. The impact of the project will benefit the entire fisheries sector by improving the livelihoods of inland and coastal fishing communities, and the women in those communities, generating better products through improved processing and packaging labeling techniques, facilitating access to new market.

One student was supported and involved in the project through thesis research, but in this project we are not lucky enough to get this thesis because this student passed away from us in January 2011 after the USAID team came to Cambodia for their monitoring and evaluation work.

The National Fisheries Post-Harvest Sector will have a formal national standard and code of practice and guideline on Fermented Fish Paste on Product development technology development, GMP/GHP Code of Practice, and Product Standard Development that finalized and approved by MAFF, ISC and future plan approved by the International *Codex Alimentarius* for use to control of product quality, safety, value added, and market.

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Appendix I: Prahoc Test Report

REPORT OF THE TESTING OF PRAHOC PRODUCED IN CAMBODIA

Prepared by Dr. Davin Uy

I. INTRODUCTION

PRAHOC is produced in Cambodia by natural fermentation of fish and salted for long preservation. Most of Cambodians are using PRAHOC for cooking for improving the taste and aroma of soups and other various Cambodian foods. Some people are eating PRAHOC without cooking. The natural fermentation is done by keeping the cleaned fish, more or less reduced fat for preserving PRAHOC against the rancidity, for 12 to 24 h to allow the natural fermentation, then the salt is added in excess quantity for preservation. The juice can be used as fish sauce production and the fish paste with salt was matured for several days to weeks for desired aroma. Normally, the salt sensitive microorganisms were eliminated after the salt addition. Some producers use $NaHSO_3$ for whitening the product for long storage. However, excess amount of this additive may cause the health implication.

The microorganisms developing during the natural fermentation and the possible toxins released by those microorganisms are not yet understood. The remained microorganisms after the addition of excess quantity of salt have not yet studied.

In this report, we are focusing on the analysis of PRAHOC for the basic parameters for better understanding of its composition. Certain tested parameters are for understanding the preservation, while the testing for certain microorganisms surviving in various PRAHOC collected from different places and producers are for understanding its risks. The following parameters are tested: Humidity, pH, Total Protein, Amino Nitrogen, Water Activity, Salt Content, Fat Content, Total Phosphorous, Total Volatile Based Nitrogen, Sulfide ($NaHSO_3$), Total Bacteria Count, Enterococcus, Fecal Coliform, Escherichia Coli and Staphylococcus Aureus. The result of the testing can be used for evaluating the qualities of PRAHOC and allow us to understand its condition for preparing the safe PRAHOC in Cambodia in the future.

II. SAMPLE RECEPTION AND ANALYSIS

15 samples of PRAHOC were received on 1 May, 2011 and the analysis was terminated on 30 May, 2011. The parameters of analysis are the following:

- Humidity is for evaluating the dry mass which can calculate the nutritional quality.
- pH is reflecting the fermentation behavior. pH is low when lactic bacteria was active during the fermentation or high pH is caused by the microorganisms releasing the ammonia during the fermentation.

- Water activity (Aw) and salt content can explain the preservation. High salt content results in low Aw value which is good for preservation during a long storage.
- Protein content is the main nutritional value of PRAHOC.
- High fat content increase the nutritional value but risk the rancidity during the long storage.
- The amino nitrogen and the volatile based nitrogen are the parameters indicating the PRAHOC fermentation and maturation. Long fermentation and/or maturation, result in increasing the amino nitrogen content and the volatile based nitrogen contents.
- The phosphorous content is explaining the possible presence of bone in the PRAHOC.
- The test of $NaHSO_3$ can evaluate if the producer added this substance of whitening PRAHOC

IV. CONCLUSION

The obtained results allow us to conclude as the following:

(i) ***Nutritional quality***: the total protein and fat contents range from 11 to 21% and from 0.16 to 12.5% respectively, but it is unlikely to be the source of protein as small quantity is consumed for each meal. Some PRAHOCs with bone present higher phosphorous content.

(ii) ***Preservation***: we observe that the salt content ranges from 14 - 35%, while some halophilous microrganisms are still active for the salt content less than 20%. Low in water activity value (about 0.45) will not allow the growth of most microorganisms. The high fat content in some samples may promote the rancidity during the preservation unless antioxidant is used.

(iii) The use of whitening ***chemical additive*** ($NaHSO_3$) was high in one sample while traces of $NaHSO_3$ in other sample may be originated from the degradation of sulfurous amino acid (cystein).

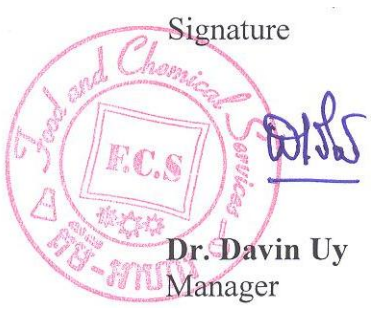
(iv) ***Bacteriological quality***: all tested samples present very high total plate count and pathogenic bacteria, however, fecal coliform and Escherichia coli were not present as these bacteria may be killed during the addition of salt during the processing. Thus, it is not safe to consume the uncooked PRAHOC.

V. PERSPECTIVE

As the preparation of PRAHOC is done by the natural fermentation which promotes the growth of both non-pathogenic and pathogenic microorganisms, it is necessary to study the process in detail to find out the useful non-pathogenic microorganisms responsible for PRAHOC fermentation. In this optic, the technology to produce the safe PRAHOC using the safe ferment will be developed.

Phnom Penh, 30 May, 2011

Signature



Dr. Davin Uy
Manager

Analysis of Prahoc samples

N	Parameters	Unit	A submitted firstly	B	C	Jar-1	Jar-3	7 days	10 days	15 days	KSP-I-3	KSP-I-3 red cap	KSP-II-3 red cap	KPCH-I-1	KPCH-II-2	KPCH-III-1	Lucky
1	Humidity	g / 100g	59.5	50.1	37.1	56.5	57.5	63.8	53.3	48.8	53.6	49.7	49.0	52.7	51.8	54.4	56.8
2	pH	-	6.34	5.80	5.80	6.65	6.64	7.56	6.19	6.14	5.62	5.50	5.66	6.15	5.89	5.50	5.58
3	Total Protein	g / 100g	18.6	18.1	11.4	19.0	21.4	19.2	19.3	20.2	18.0	15.5	18.4	16.7	19.0	16.3	18.4
4	Amino acid nitrogen	g / 100g	2.32	0.428	0.238	0.377	0.423	0.587	0.222	0.326	0.340	0.431	0.409	0.399	0.645	0.504	0.481
5	Water activity (Aw)	-	0.77	0.47	0.47	0.47	0.47	0.44	0.48	0.48	0.48	0.47	0.48	0.47	0.47	0.47	0.48
6	Salt (NaCl)	g / 100g	25.7	28.5	35.2	28.6	21.9	14.2	20.8	14.0	26.7	17.7	26.7	21.7	23.8	23.1	26.6
7	Lipid content	g / 100g	0.16	1.64	5.67	0.22	0.08	5.03	3.77	12.49	5.20	9.36	2.34	4.17	4.49	4.26	1.73
8	Total phosphorous	g / 100g	< 0.001	0.23	0.41	0.09	0.26	0.38	0.24	0.31	0.27	0.18	0.26	0.62	0.44	0.13	0.09
9	Total volatile base nitrogen	g / 100g	0.48	0.020	0.003	0.008	0.004	0.019	0.014	0.014	0.007	0.022	0.004	0.014	0.007	0.006	0.007
10	$NaHSO_3$	mg / 100g	95	3.56	4.49	7.57	1.69	2.63	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.85	1.79	0.84	0.86
11	Total Plate Count	count/ g	588900	40700	216900	7800	125000	26900	59600	327800	105200	152700	10700	7000	6900	3000	32700
12	Enterococcus	count/ g	0	0	0	0	0	0	0	29180		0	0	3160	0	0	0
13	Fecal coliform	count/ g	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	Escherichia coli	count/ g	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	Staphylococcus aureus	count/ g	1600	1400	0	0	0	80	180	0	400	0	330	2800	130	100	260

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FISH PROCESSING: GHP/GMP CODE OF PRACTICES AND PRODUCT STANDARD FOR PRAHOC

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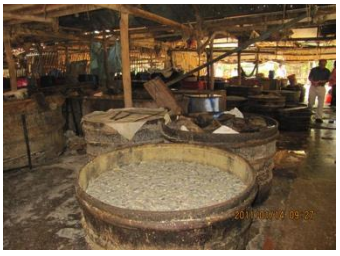



Appendix II: Fish Processing and GHP/GMP Code of Practices for Prahoc

1. SCOPE

- These technical standards defines the basic conditions for safety and hygiene assurance for establishments that process commercial fermented fish paste (PRAHOC) fit for human consumption.
- These technical standards are applied to fermented fish paste (PRAHOC) that takes fish as a main raw material and are made through the corresponding process.

2. TERMINOLOGY AND DEFINITIONS

-Fish Paste (PRAHOC) is a Cambodian traditional product prepared from fermented freshwater fish. This product is consumed as is or used as a condiment after fermentation for three months minimum. (Refer to research output and consultation with fish processors and post-harvest fisheries stakeholders).

-Fish Paste (PRAHOC) is a processed fishery product prepared by a series of processing steps which include washing, heading, scaling, salting and fermenting in the jars.

2.1 Processed PRAHOC Products

-Boneless PRAHOC: have undergone a series of processing steps which include raw material receiving, first cleaning, heading and filleting, second cleaning, first soaking (for whole night), first draining, first salting and kneading, storage not longer than 36 hours, draining for two days and one, second salting, second draining (for 15-20 days), curing and sprinkle of brine water on drained fish, second fermenting in jars/wooden containers/cement concrete containers, packaging/ labeling, and distribution.

2.2. Cross- Contamination, transfer of contaminants (biological, chemical or physical) from any sources to PRAHOC products.

2.3. Clean Water, water that fulfils the requirements of the safety water.

3. Technical Standards for Hygienic Operation of PRAHOC Processing

3.1 PRAHOC Processing

3.1-1 Steps for Boneless PRAHOC Processing

Raw material receiving

↓

First cleaning

↓

Heading and filleting

↓

Second cleaning

↓

First soaking/fermenting (for overnight)

↓

Draining (1st) for 12 hours

↓

First salting and kneading (storage not longer than 36 hours)

↓

Draining for two days and one night

↓

Second salting

↓

Third draining (for 15-20 days)

↓

Curing and sprinkle of brine (brine is salt water) on drained fish

↓

Second fermenting in jars/wooden containers/cement concrete containers

↓

Packaging

↓

Labeling

↓

Distribution

3.1-2 **Steps for Bony PRAHOC Processing**

Raw material receiving

↓

First cleaning

↓

Heading and scaling

↓

Second cleaning

↓

Draining (1st)

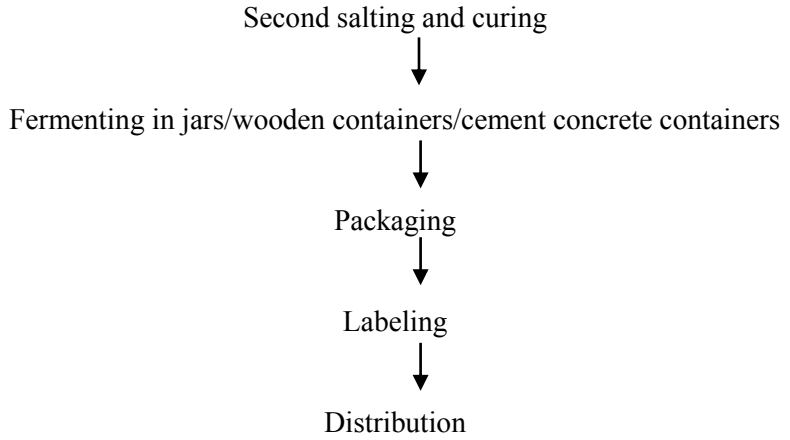
↓

First salting

↓

Second draining

↓



3.2 Processing Step Description

3.2.1 Boneless PRAHOC Product

3.2.1.1 Receiving of Raw Material

- The raw material must be fresh; free from the contaminants; and kept in good hygienic condition.
- Salt must be of food grade; free from the contaminants; and kept in good hygienic condition.

3.2.1.2 First Cleaning

- Raw material must be carefully cleaned with clean water in order to avoid cross contaminations.

3.2.1.3 Heading and Filleting

- Fish shall be headed and filleted while avoiding cross-contaminations.

3.2.1.4 Second Cleaning

- Filleted fish must be carefully cleaned with clean water while avoiding cross contamination.

3.2.1.5 First Soaking/Fermenting

- Filleted fish after cleaning are subjected to soaking/fermenting with clean water for overnight while avoiding cross contamination.

3.2.1.6 First Draining

- Fish shall be drained in the shade for one hour at normal temperature while avoiding cross contamination.

3.2.1.7 First salting and kneading (storage not longer than 36 hours)

- Fish shall be mixed with salt at a 15-30 kg salt to 100 kg fish ratio and allowed to stand for 1 day for uniform salt diffusion while avoiding cross contamination.

3.2.1.8 Second draining

- Fish shall be drained under the sun light for two days and one night at normal temperature in the shade while avoiding cross contamination.

3.2.1.9 Second salting

- Fish shall be mixed again with salt at 10-15 kg salt to 100 kg fish ratio and held for 15 days while avoiding cross contamination.

3.2.1.10 Third draining (15-20 days)

- Fish shall be drained on the rack covered with a mosquito net for 15-20 days at normal temperature in the shade while avoiding cross contamination.

3.2.1.11 Curing and Sprinkling brine on drained fish

- Fish shall be cured and sprinkled with brine water while avoiding cross contamination.

3.2.1.12 Second fermenting in jar/wooden container/cement concrete container

- Salt shall be added enough to cover the surface layer followed by adding brine to pack the salt layer. Salted fish shall be stored for up to 3 months to allow fermentation.

3.2.1.13 Packaging

- PRAHOC shall be properly packed with food grade packaging materials while avoiding cross contaminations.

3.2.1.14 Labeling

- Labeling shall be done in accordance with labeling standards (CS001-2000).

3.2.1.15 Distribution

- PRAHOC shall be distributed in the packages that protect the safety and quality.

3.2.2 Bony PRAHOC Product

3.2.2.1 Receiving of Raw Material

- The raw material must be fresh; free from the contaminants; and kept in good hygienic condition.
- Salt must be of food grade; free from the contaminants; and kept in good hygienic condition.

3.2.2.2 First Cleaning

- Raw material must be carefully cleaned with clean water while avoiding cross contamination.

3.2.2.3 Heading and Scaling

- Fish shall be headed and scaled in order to avoid cross contamination.

3.2.2.2.4 First Draining

- Fish shall be drained for 2 hours at normal temperature in the shade while avoiding cross contamination.

3.2.2.2.5 First Salting

- Fish shall be mixed with salt at a 15-30 kg salt to 100 kg fish ratio and allowed to stand for 1 day for uniform salt diffusion while avoiding cross contamination.

3.2.2.2.6 Second Draining

- Fish shall be drained for 12 hours at normal temperature in the shade while avoiding cross contamination.

3.2.2.2.7 Second Salting

- Fish shall be mixed again with salt at 10-15 kg salt to 100 kg fish ratio and held for 15 days while avoiding cross contaminations.

3.2.2.2.8 Second Fermenting

- Salt shall be added enough to cover the surface layer followed by adding brine to pack the salt layer. Salted fish shall be stored for up to 3 months to allow fermentation.

3.2.2.2.9 Packaging

- PRAHOC shall be properly packed with food grade packaging materials while avoiding cross contamination.

3.2.2.2.10 Labeling

- Labeling shall be done in accordance with labeling standards (CS001-2000)

3.2.2.2.11 Distribution

- PRAHOC must be distributed in the packages that protect the safety and quality.

4 General Regulations on PRAHOC Processing Establishments

4.1 Location

- The establishments for PRAHOC processing must be located in a suitable area which is free from objectionable odors, smoke, dust and other contaminants coming from the surrounding environment; and from flooding caused by rainwater or high tide.
- If the establishments are affected by any of the above causes, necessary measures shall be taken to prevent their contamination.
  - Location of the establishments for PRAHOC processing must provide the following: after supply should be adequate for all operations of PRAHOC processing.
  - Transportation of raw materials and PRAHOC products must be readily available.

4.2 Design and Layout

- The establishment must be fenced off
- The design of a premises must permit safe and hygienic operation with easy cleaning. (generally, cleaning includes sanitation and disinfection)
- The premises must also be designed and maintained to prevent harboring of pest and contamination of smoke, dust, odors, etc.
- The premises must provide proper separation for various operations either by partition, location or other effective means.
- Adequate working space must be provided to allow for satisfactory performance of all operations and to ensure hygiene and safety.
- Areas used for nonfood operations must be separated from the food production area or the areas in which the products not fit for human consumption are produced.

4.3 Construction

4.3.1 General Requirement

- The building must be of sound construction and maintained in good repair, adapt to the nature and scope of the establishment, and ensure the hygiene and quality standards of PRAHOC products.
- The materials used in the construction of the floors, walls, ceiling, etc. must not release hazardous substances directly or indirectly to the PRAHOC products.

4.3.2 Surrounding of PRAHOC Processing Premise

- The concrete surrounding outside the building must be at least 1.2 m wide with a necessary slope for proper drainage
- The surrounding areas must be kept clean.

- The parking areas must be surfaced with concrete, asphalt, gravel, or similar materials to minimize dust and kept clean.

4.3.3 Floor of Processing Plant

- Floor must be paved with hard, durable, non-permeable and non-slip material without crevices and puddle, and easy to clean and sanitize.
- The junctures between floors and walls should be sealed to facilitate easy cleaning.

4.3.4 Drainage

- In any area which involves a "wet" operation:
  - Floors must slope sufficiently at least 1:48 (2%) for liquids to drain to trapped outlets;
  - Floor drains must be provided and be adequate in size, number and location to handle the maximum flow of water under normal working conditions.
- All drains must be constructed in such a way that odor is prevented from entering the facilities, screened to prevent the entrance of pests and vermin, and be easy to clean.
- Solid traps installed in conjunction with floor drains must be designed to enable adequate cleaning.
- Floor drains must not be connected with sanitary drainage. Where floor drains are connected to a rainwater drainage system, they must be designed and maintained to ensure that flooding of the premises does not occur.

4.3.5 Walls

- In rooms where PRAHOC product is produced, stored or transported, the walls must be constructed with durable and water-impervious materials and be light-colored and smooth.
- Any walls or parts that do not abut the ceiling must be capped to prevent dust accumulation. A minimum slope must be at least 45 degree.
- All piping, conducting-wires along the walls must be sunk in the walls or covered and fixed far from the walls 10 cm for easy cleaning and preventing the harboring of vermin.

4.3.6 Ceilings

- Must be constructed of smooth, durable, impermeable and light colored material, and should be easy to clean and not be flaked.

4.3.7 Windows, Doors and Vents

- Windows, doors and vents are not permitted open in areas where processed PRAHOC products are exposed, processed or packed.
- Open able windows and vents must be fitted with insect-proof screens which are easily removed.
- Window sills shall be sloped inward at least 45 degrees and be at least 1m from the floor to prevent the accumulation of dust.
- Doors and hatches shall have smooth, non-absorbent surfaces and shall be close fitting. If doors, windows and hatches are made from safety glasses, all joints between glasses and frames shall be sealed by silicon.
- Doors, hatches and other openings to outside of the building or where physical separation is required shall be installed with strip curtains, air curtains, or a self- closing device.
- Processing area shall not open directly to the machine room, toilets, and area where processing waste is loaded and stored.

4.3.8 Equipment and Utensils

- All equipment and utensils that may contact the product, must be: made of materials which do not transmit odor, taste or toxic substances, and are non-absorbent, resistant to corrosion, capable of withstanding repeated cleaning and disinfecting, smooth, and easy to clean.
- In case of using the concrete tub for fermenting, the contact surface must be smooth and free from toxic substances.

4.3.9 Transport Means

- The transporting vehicle must be suitable and clean, and loading and transportation must be conducted in such a way as to protect products from damage and potential sources of contamination, and to ensure the packaging integrity.
- The vehicle for transporting the raw materials must be equipped with an adequate chilling system.
- The transporting vehicle for final products must be operated while avoiding any damage and cross contaminations; and maintaining the packaging integrity

4.3.10 Waste Treatment System

4.3.10.1 Wastewater Treatment

- The establishment shall have a wastewater treatment system and it must be maintained in good operation condition.
- Wastewater after treatment must satisfy the requirements for hygiene and safety standards. The untreated wastewater is not permitted to be discharged into the surrounding environment.

4.3.10.2 Waste Handling

- The establishment shall have appropriate equipment for collection of waste to prevent odor and other adverse effects on the establishment and surroundings.
- Waste shall be collected and disposed from the processing area at least every 2 hours and shall not be stored in the processing area.
- The waste room shall be placed well away from the room or area where fishery products are handled. The waste room shall also have separate ventilation and be easy to clean and sanitize periodically.

4.4 Quality Control Facilities

4.4.1 Quality Management Team

- The establishments shall assign a Quality Management Team to ensure the relevant quality assurance activities planned and performed.
- The QM staff and production supervisors shall have a broad experience and be properly trained in relevant fields such as fish processing, quality control and sensory evaluation.

4.4.2 Hygiene Facilities

4.4.2.1 Hand Washing Facilities

- The establishment must have sufficient hand washing facilities adjacent to personnel entrances to the processing area and in the toilets.
- These facilities must be provided with non-manually operated taps, an adequate supply of clean water, soap dispensers, and suitable and sufficient hygienic means of drying hands;
- In processing area of high risk products, there must be both hand washing and sanitizing facilities.
- Notes must be clearly posted near the food handling area entrances directing personnel to wash their hands on entering or re-entering processing areas.

4.4.2.2 Boot Sanitizing Basins

- Establishment must provide boot sanitizing basins (footbaths) at the entrance of each processing room so that every person entry processing area shall sink their boot in it
- Sanitizing basins must have:
  - Sanitizer-containing water with a depth more than 15 cm, a drainage hole to replace water periodically, preferred sanitizers are iodopher at 200 ppm and quaternary ammonium compound (Quat) at 400-600 ppm (chlorine is not recommended since it is easily deactivated).
  - Drainage water from hand washing basin must not be flowed into the boot sanitizing basins.

4.4.2.3 Changing Rooms

- The establishment must have changing rooms that are located at a suitable place with proper dimension.
- Changing rooms must:
  - Have no door opened directly to processing areas;
  - Be separated for man and woman, include sufficient storage for personal belongings and provide a separate space for keeping clothes.

4.4.2.4 Equipment for Washing Up and Disinfection

- The establishment shall have adequate washing-up facilities for cleaning and sanitizing processing equipment and utensils.
- There shall be separate cupboards, shelves or rooms closed and locked for cleaning and sanitizing agents, etc. Such cupboards or rooms shall be appropriately placed and well ventilated.
- Cleaning and sanitizing agents must be labeled with clear information of the name and necessary directions for use.

4.4.2.5 Sterilizing Facilities

- If the sterilizing medium of a sterilizing facility is not water, the method of sterilization must be approved by Fisheries Administration.
- If the sterilizing medium is water, the facility shall be fitted with suitable means of supplying hot and cold water in sufficient quantities.
- Sterilizing facilities must be constructed with corrosion resistant materials and easy to clean.

4.4.2.6 Hygienic Operating Conditions

4.4.2.6.1 General Provisions

- PRAHOC product shall be handled and stored in such way as to prevent contamination and spoilage.
- Cross-contamination of PRAHOC products shall be avoided at all stages from raw materials to marketing of PRAHOC finished products.
- Final products shall be kept at ambient temperature.
- Persons who handle unwrapped PRAHOC products must not at the same time carry out other operations that may contaminate the products.
- PRAHOC products, crates, cartons, basins and containers shall not contact and not be placed on the floor.
- Dogs, cats and other animals must not be admitted to the premises.
- It is prohibited to use tobacco, spit, eat or drink on premises.
- Any person, who enters production areas, shall wear protective clothing, a hair restraint and protective footwear.

- Any other products (e.g. animal feeding stuff, waste, rejects) that may have an undesirable effect on PRAHOC product for human consumption, shall not be produced or stored together with them.
- Vehicle that emits contamination (soot, etc.) shall not be used in premises where PRAHOC products are produced.
- No objects or equipment that are irrelevant to the work of the establishment shall be stored or used on the premises, including equipment and objects that are not permitted used or that are no longer in use.

4.4.2.6.2 Maintenance

- The maintenance program shall be planed and implemented by the establishment such as self inspection on status of premises, equipment, machines, utensils, and maintenance or repair in good conditions.

4.4.2.6.3 Water Supply

4.4.2.6.3.1 General Requirements

- Water used for PRAHOC processing must be clean.
- An ample supply of water must be available throughout an establishment with adequate pressure and suitable temperature, and meet the requirements mentioned in the appendix-A.

4.4.2.6.3.2 Water Treatment

- If necessary, the water shall be treated by filtration and chlorination in order to achieve the water quality standards in Appendix A.
- If the water used in the plant receives additional treatments prior to use (e.g. use of ultraviolet treatment...), this shall be done in accordance with the instructions of the manufacturer of any equipment or chemicals used.

4.4.2.6.3.3 Storage of Water

- The establishment should possess an adequate water storage tank with sufficient capacity to supply the requirements of the establishment when operating at maximum capacity.
- The water storage tank shall be well constructed and the internal surfaces shall be smooth and impermeable using cement of acceptable quality.
- Each water storage tank shall be provided with an impermeable hatch, which permits entry for cleaning and inspection purposes. The design of hatch shall protect against the entry of rainwater or any water, which may flow out of the plant.
- Each water storage tank shall be protected by adequate screening of any ventilation pipes.
- The area surrounding each water storage tank shall be maintained clean and free of accumulation of rubbish, dust, water and other materials, which could contaminate the water inside.
- The establishments shall set up a plan to clean periodically the water storage tank.

4.4.2.6.3.4 Water Piping System

- There shall be cleaned water supply system used for processing operations that are separated from the unclean water supply system. There shall be a flow diagram for each supply system.
- The outlets and distribution lines of clean water in processing area shall be numbered both in practice and on the scheme to serve the sampling for analysis in every month.
- Unclean water may be used for subjects that is not food, must be carried in completely separate lines, identifiable, preferably by color, and with no cross-connection with the system carrying clean water.

4.4.2.6.3.5 Ice Supply

4.4.2.6.3.5.1 General Requirements – Ice used to chill fish shall be:

- made from clean water;
- made, stored, transported, distributed and used in hygienic conditions;
- Samples of ice shall be taken regularly for microbiological tests;
- The microbiological criteria for ice used for chilling fish shall meet the water quality standards in the appendix-A.
- In case of using ice manufactured in other than the establishment, those establishments must meet all requirements of hygiene and safety.
- An ice transportation unit shall be designed so that it can be easily cleaned, be constructed of hard, durable, noncorrosive materials, and shall not release hazardous substances to the fishery products.

4.4.2.7 Pest Control

- The establishment shall have a written effective plan for the control of rodents, birds, insects and other pests.
- If poisonous substances are used, these shall be stored in the lockable cupboards or rooms, and be used in such a way that they do not contaminate fish and fishery products.

4.4.2.8 Cleaning and Sanitizing

- There shall be an assigned staff or team to carry out a cleaning program adapted to the nature and scope of the establishment.
- Fittings and equipment surfaces that come in contact with PRAHOC products and may contaminate, shall be cleaned and sanitized after middle shift rest and also when the shift is finished.
- Hosing down of premises, equipment, etc. shall be restricted so as to avoid unnecessary splashing. Floors and equipment or utensils shall not be hosed when there are unwrapped fish products in the same room.
- Cleaning agents and disinfectants used must be on the permitted list and appropriate for the purpose.
- All remains of such substances on surfaces that can come into contact with PRAHOC products must be rinsed away with clean water before the equipment is used again.

4.4.2.9 Personal Hygiene

4.4.2.9.1 General Requirements

- Persons who contracted infectious diseases or carry an infection that can be transferrable to fish and fishery products, or who have infected wounds, boils or other skin infections must not participate in working operations whereby they can directly or indirectly contaminate fish and fishery products.
- People, who are working with fish and fisheries product, shall have medical examination every year in accordance with the regulations of Ministry of Health.
- Personal Health documents shall be kept properly by the establishment and made available to the inspection authority upon request.

4.4.2.9.2 Working Clothes

- Persons, who handle fish and fishery products, must wear protective clothing and footwear, head-covering that encloses the hair and the beard or moustache, or both. If gloves are used, they shall be in sound, clean and sanitary condition.
- The working clothes shall not have outer pockets and be differentiated for each processing area. Especially, the person who is working in the high risk areas.
- Protective clothing shall be cleaned every day by the establishment.
- Protective outer clothing used in food handling area must not be worn outside the processing areas.

- Personal property, articles of clothing and objects irrelevant to operations shall not be stored in rooms where fish products are produced.

4.4.2.9.3 Personal Cleanliness

- Person who handles PRAHOC products shall wash their hands: on entering the fishery product handling area, after using the toilet, after touching the nose or mouth; or after contact with any contaminated substances.
- Any cut or wounds on hands and forearms shall immediately be covered by a suitable water-proof dressing after proper treatments.
- Personal behavior; People engaged in fish and fishery products handling activities should refrain from behavior, which could result in contamination of PRAHOC product, for example:
  - Smoking;
  - Spitting;
  - Chewing or eating;
  - Sneezing or coughing over unprotected PRAHOC products.
- Personal accessories such as jewelry, watches, pins or other items should not be worn or brought into fish and fishery products handling areas if they pose a threat to the safety and suitability of food.
- Cosmetics shall not be used by the workers during working.

4.4.2.9.4 First Aid Box

- The plant shall be provided with a first aid box, which should contain at the minimum: a sufficient quantity of impermeable dressings, antiseptic cream, cotton wool, adhesive tape, and a suitable wound disinfectant.

4.4.2.10 Training

- All staff shall be trained on GMP, GHP, and safety work at the beginning and receive a refresher training every year.
- The workers must be trained before carry out their task and retrained every year on food hygiene, personal hygiene, good manufacturing practices, and work safety.
- The staff, which is using chemicals, shall be trained properly.

4.4.3 Packaging

- PRAHOC products should be packaged to protect safety, quality and physical integrity of products using an appropriate packaging system while avoiding cross contamination.

4.4.4 Transport

4.4.4.1 General Requirements Regarding Transport

- PRAHOC products shall be handled with care during loading, unloading and transport, to avoid damaging or soiling the packaging or products.
- Facilities used for transport of fish products may not be used for other products which may affect or contaminate the fish products, except when thoroughly cleaned and sanitized to ensure that fish products are not contaminated or adversely affected in any other way.
- Internal surfaces and any equipment in transport facilities for fish products shall be smooth and easy to clean and disinfect.
- PRAHOC products shall not be transported by means of equipment that is not clean.
- The transport equipment and means shall be cleaned and sanitized before and after each transport.

5 Safety and Quality Management System

5.1 Traceability and Recall of Defective Products

- The enterprise must elaborate regulations in writing for traceability and recall of products in case food safety hazards are found after the products have been shipped.
- The enterprise must carry out the traceability procedures, and when necessary, must notify the concerned parties (authorities and customers) and recall of defective products.
- When establishing the traceability procedures, the enterprise must elaborate very specific measures to ensure that they are able to recall products that have defects both inside and outside the enterprise.
- Documents concerning procedures on traceability and recalling defective products shall be kept in files in accordance with stipulations.

5.2 Monitoring Program

- The enterprise must monitor for all steps of both processing chains and GHP/GMP operation condition from receiving of raw materials until products distribution.
- Given the fundamental importance of this program, it is critical to employ effective monitoring procedures. A failure in monitoring procedures will result in a significant risk in the production of safe food. All fish processing establishments are expected to have an effective cleaning and disinfection program in place, as there is such a wealth of information on both the importance of this area from a food safety perspective and the means to develop and implement an effective cleaning and disinfection program.
- The most common form of monitoring involves the senses, e.g. visual inspection after cleaning, smelling the presence of offensive odors, and feeling for greasy surfaces.
- This monitoring will be done by supervisors and/or quality assurance staff every time a cleaning operation is undertaken. Monitoring will also be continuous during processing operations.
- The manual needs to detail the monitoring of both the cleaning and disinfection procedures used in the factory. It will describe what is being monitored, how the monitoring is achieved e.g. visual inspection, test kits, etc., who will do the monitoring and how frequently the monitoring is undertaken.

5.3 Corrective Actions

- When monitoring detects problems with any of steps or GHP/GMP operation conditions, an immediate evaluation shall be required to determine what steps need to be taken.
- A step needs to be taken in order to identify suspected products and remove them from the distribution chain until their safety has been established.
- If it becomes clear that all processing steps have not met the GHP/GMP operation requirements, appropriate corrective actions should be taken. In each of these cases, record keeping should follow indicating non-compliance if there is, and corrective actions to be taken and confirmed if they have resolved the problems.
- The manual needs to detail the corrective actions that will be taken in the fish processing establishment when the limits established in the monitoring procedures are exceeded. It also needs to detail the responsible person(s).

5.4 Record Keeping System

- The enterprise shall establish procedures governing documentation, checklists concerning QM implementation and regularly review QM records and documentation.
- Records and checklists associated with monitoring QM system must be prepared in such a way that they are clear and easy to understand by the users. They must be realistic, reviewed and approved by the authorized official before being in use or whenever changes are made.
- All documents and records must include at least the following information:

a. Name and address of the enterprise

b. Date, and time recorded and signature of person doing record
c. Results of monitoring
d. Date verified, and signature of official doing verification of the records.
e. Name or code of the product, lot of products related.

- A person(s) must be assigned to supervise and make records on-site at frequency stipulated in the checklist. Records of monitoring results must be kept without any correction, or changes.
- Documentation and records must be maintained in period depending on shelf-life of each type of product, with respect to legislation or commitment with the consumers. They must be kept for at least:

a. 2 years for frozen, processed products such as PRAHOC.
b. 2 years for manuals concerning operating of equipment or technology

- Record keeping might be done on computer. In this case, the enterprise must have internal guidelines detailing what contents to be maintained, computer operation practices, data handling, data saving, security, person in charge and others relating to preventing loss of data on computer.
- The enterprise shall assign (in writing) labor force for records review and audit at the following frequency:

a. Daily
b. Weekly
c. Monthly

- Overview periodically

5.5 Verification Program

- The enterprise shall verify all corrective actions. A failure in the verification program will result in a significant risk in the production of safe food.
- Verification of corrective actions is important for the next monitoring program.

6 APPENDIX A: Additional Quality Standards for Clean Water

6.1 Additional criteria
6.2 pH (The pH of clean water used in the processing of PRAHOC products should fall within the range 6.5-8.5).
6.3 Chlorine concentration
6.4 The concentration of chlorine in the water used in the plant should be less than 1mg/l (1ppm).
6.5 The addition of chlorine should be adjusted in order to maintain the specified concentration at the point of use inside the plant.
Delay of at least 30 minutes should be observed between the treatments of water with chlorine, and only that water treated by this way should be used for processing of fishery product.

Appendix III: Product Standards for PRAHOC

FOREWORD

Currently, the need of traceability in relation to food quality and food safety for consumers is increasing. The quality of fish and fishery products is an important concern of the industry and consumers. Deterioration of fishery products mainly occurs as a result of microbiological activity and biochemical and chemical changes during processing and storage. Raw material quality and processing conditions are the most important factors that affect the quality of fishery products.

PRAHOC (salted and fermented fish product) is traditionally popular in Cambodia. PRAHOC product has been shown to be safe for millenniums. Freshwater fish (Snakehead, Mud carp and Trichogaster and their family) are by far the most important species for salted and fermented fish processing. PRAHOC is one of the most important food products for the economy of Cambodia and is a traditional product. The traditional production of PRAHOC is a simple process in which freshwater fish are scaled, headed, soaked in brine or mixed with dry salt, piled up, and stored for fermentation. There are two types of PRAHOC: "PRAHOC Chaeng or Bony Fermented Fish Paste" (ordinary PRAHOC) with bones in and "PRAHOC Sach or Boneless Fermented Fish Paste" with bones removed. PRAHOC is one of the principal salted; fermented products consumed in Cambodia and are used in the preparation of many traditional dishes. Salt decreases the water activity of the product as it diffuses into food structure. Salting and fermentation preserve products and promote protein autolysis releasing savory amino acids and other flavors. This results in sensorial changes that make the final product more palatable.

Generally, the quality of the salted, fermented fishery products depends on the quality and chemical composition of raw material. In addition, the salt composition affects the quality of salted fish. Usually, edible salt as specified in the Cambodian Standards CS 0055:2007 is used in order to obtain the desired texture and flavor.

This product standard lays down general and specific requirements for salted, fermented fishery products (PRAHOC). Use of the standard is voluntary and the standard shall provide an unambiguous description and understanding of Cambodian fishery products.

REFERENCES

- Cambodian Standard CS 003:2003 on Fish sauce
- Cambodian Standard CS 0055:2007 on Edible salt (ordinary, washed and iodized)
- Cambodian Standard CS 001:2000 on labeling of food product
- CODEX STAN 233-1969 on sampling plans for prepackaged foods
- CODEX STAN 167-1989, Rev. 1-1995- for salted fish and dried salted fish of the Gadidae family of fishes
- AOAC testing methods 17th edition, 2000.

PRODUCT STANDARD FOR PRAHOC

1. Scope

This standard specifies type, requirements, hygiene, packaging, marking and labeling, sampling, testing and criteria for conformity for PRAHOC products that are made from freshwater fish for human consumption.

This standard does not cover the products that are made from marine fish in whole or any part.

2. Definition

For the purpose of this standard, the following definitions apply.

2.1 Fish: any of the cold-blooded aquatic vertebrate animals living in water and having fins, permanent gills for breathing.

2.2 PRAHOC: A salted, fermented fishery product that can be obtained by the traditional processing method which consists of heading, scaling, washing, salting, draining, drying and fermenting. This product has unique characteristics in terms of flavor and texture. The fermentation process transforms large molecules into smaller ones, primarily proteins, through hydrolysis the combined actions of micro-organisms and enzymes making the product flavorful.

2.3 PRAHOC Cha-eng (Bony Fermented Fish Paste): A PRAHOC product with bones in. Mostly, it is made from Cyprinidae family such as *Henicorhynchus lobatus/siamensis*.

2.4 PRAHOC Sach (Boneless Fermented Fish Paste): A PRAHOC product with bones removed. Mostly, it is made from snakehead (*Channidae*) or Trichogaster.

2.5 Salt: salt (sodium chloride) of an appropriate quality suitable for the purpose.

2.6 Contaminant: any biological or chemical agents, foreign matters or other substances that may compromise food safety or suitability.

2.7 Contamination: the introduction or occurrence of contaminants in food.

2.8 Pest: any unwanted and destructive insect or other animal that attacks food including birds, rodents, insects, worms and arachnids.

2.9 Water activity (a_w): Ratio of the water vapour pressure in the foodstuff to the vapor pressure of pure water at the same temperature. It is used to predict food product stability against microbial spoilage.

2.10 Whole fish: whole fish as captured,

3. Type:

The PRAHOC shall be available in two types as follows.

- PRAHOC cha-eng (Bony fermented fish paste)
- PRAHOC sach (Boneless fermented fish paste)

4. Raw materials

4.1 Fish: The whole fish or its part that is in a condition for human consumption, shall be used as raw material for the production of PRAHOC.

4.2 Salt: Edible salt such as ordinary, washed or iodized salts that comply with the requirements of Cambodian standard CS 0055:2007- edible salt (ordinary, washed and iodized), shall be used as a main ingredient for production of PRAHOC.

5. Requirements

5.1 General requirements

5.1.1 PRAHOC Cha-eng (Bony Fermented Fish Paste)

The product shall be prepared from the whole fish or its part as specified in Clause 2.3 in which fish is processed with bones in.

5.1.2 PRAHOC Sach (Bonless Fermented Fish Paste)
The product shall be prepared from whole fish meat or its part as specified in Clause 2.4 in which fish is processed with bones removed.

5.1.3 Free From Defect
The products shall be free from live insects infestation or part or whole dead body.

5.1.4 Free From Unsafe Additive
The products shall be free from any additive that renders it unsafe or unsuitable for human consumption except for edible salt specified in Clause 4.2.

5.1.5 Foreign Matter
The products shall be free from glass, sand, metals, woods, insects and dead insect fragments, and fungal contamination, dead rodents, worms and dead worm fragments and other extraneous materials.

- **PRAHOC Cha-eng:** Other than the extraneous matter mentioned above, the PRAHOC Cha-eng may contain its own bones or scales.
- **PRAHOC Sach:** Other than the extraneous matter mentioned above, the PRAHOC Sach shall have its own bones or scales not in excess of 0.01g/kg of the product.

5.1.6 Taste and Odor
The products shall have desirable characteristic as indicated in the Table 1.

Table 1: Sensory Parameters

Parameter	Requirements	Method of Test
Taste and odor	Having the natural taste and odor for the variety, without offensive taste or rancid or objectionable odor	Annex-A

5.2 Chemical Requirements
The PRAHOC shall have chemical properties conforming to those given in Table2.

Table 2: Chemical Properties

No.	Parameters	Requirements	Method of Test
1	Moisture, percent by mass, max	45%	Annex-B
2	Water activity (a_w), max	0.48	AOAC 950.46B
3	Salt content, percent by mass, max, calculated as NaCl	15 - 35%	AOAC 971.21
4	Acid insoluble ash, percent by mass, on a dry weight basis, max	1.5%	ANNEX-C
5	Protein, percent by mass	12 - 25%	ANNEX-D
6	Total volatile base nitrogen(TVB-N) (mg/100g)	0.008	Annex-E

5.3 Contaminants

5.3.1 The product may not contain contaminants like mercury, cadmium, lead and arsenic in the amounts of which are significant for human health.

5.3.2 Coloring Matters

No added coloring matters shall be used.

5.3.3 Preservatives

No preservatives shall be added.

5.4 Microbiological Requirement

Microorganisms in the PRAHOC product shall not be found to exceed the following amounts given in Table 3.

Table 3: Microbiological Properties of PRAHOC Product

No.	Microorganism	Requirement	Testing method
1	Total plate count	10,000/g	ISO 4833:2003
2	*Escherichia coli (E. coli)*	<230/100g	ISO/TS 16649-3:2005
3	*Listeria monocytogenes*	100/g	ISO\11290-1:1996/Amd.1: 2004
4	Yeast and Mold (cfu/g)	none	ISO 21527-2:2008

6. Hygiene

The hygienic requirements of production process should conform to the Cambodian Standards CS 084:2010 (Common principles and requirements for Food Hygiene).

7. Packaging

The PRAHOC product shall be packed in entirely enclosed packages and/or wrapped in suitable packaging materials which do not adversely affect the nature of the product. The containers or packaging material shall be cleaned and made from glass or plastic (PE, PET) that is suitable for packing food for human consumption and protects a product from contamination.

8. Marking and labeling

The labeling of the product shall be applied in conformity with the Cambodian standard CS 001:2000-labeling of pre-packaged food.

At least the following information shall be marked on each container.

a. Name of the product " PRAHOC cha-eng or PRAHOC Sach"
b. Name and address of manufacturer, packer or distributor
c. Trade name, if any
d. Net weight in g or kg
e. lot number
f. Manufacturing and expiration dates
g. Country of origin.

In case of foreign language is used, the meaning shall correspond to the above information.

9. Sampling

9.1 Definition:

9.1.1 Lot: Any consignment of Prahok of the same grade, packed in container of the same size, same time and bearing the same brand name, mark or trademark shall be considered as a lot.

9.1.2 Lot Size: Number of container units in a lot.

9.1.3 Sample size (n): The number of containers of prahok taken from the lot for inspection.

9.1.4 Acceptance Number (c): The number in a sampling plan which indicates the maximum number of defectives permitted in the sample in order to consider the lo**t** as meeting the requirements of Standard.

9.2 Sampling Procedure

When drawing samples, the following precautions shall be taken:

9.2.1 The sampling instruments shall be clean and dry when used. When drawing samples for the microbiological examination, the sampling tools shall be sterilized.

9.2.2 The samples shall be kept in clean, dry glass or suitable containers or shall be kept in sterilized containers.

9.2.3 The sample containers shall be sealed air-tight and marked with necessary details of sampling.

9.2.4 The samples shall be stored in such a way that there will be no deterioration of the quality of the material before analysis.

9.3 Scale of sampling

9.3.1 Samples for testing shall be drawn at random from the same lot in accordance with the sample size given in Table 5.

Table 5: Sampling plan

Lot Size (Number of Containers)	Sample Size	Acceptance Number
not more than 4 000	6	1
4 001 to 12 000	13	2
12 001 to 24 000	21	3
More than 24 000	29	4

9.4 Preparation of the Sample for Microbiological Testing

Samples drawn for testing shall be prepared for microbiological analysis first. A sub sample of six (06) packages shall be selected from the packages selected as in 9.3.1. Approximately equal sufficient quantities of material shall be drawn from each package using an appropriate sampling instrument and transferred to six different sample containers.

9.5 Preparation of the Composite Sample

Composite samples shall be used to examine chemical residues and contaminants.

Approximately equal quantities shall be drawn from each package selected as in 9.3.1 using an appropriate sampling tool, and mixed to get a composite sample of sufficient size and transferred to a moisture proof sample container.

9.6 Number of Tests

9.6.1 Each package selected as in 9.3.1 shall be inspected for packaging, marking and labeling requirements, appearance, taste and odor and foreign matter.

9.6.2 The six samples prepared as in 9.4 shall be tested for the requirements given in 5.3

9.6.3 The composite sample prepared as in 9.5 shall be tested for the requirements given in 5.2 and 5.4

10. Criteria for Conformity

A lot shall be declared as it conforms to the requirements of the standard if the following conditions are satisfied.

10.1 The test samples satisfies all requirements given in clause 5.1 and 8

10.2 Each package inspected as in clause 9.6.1 satisfies the relevant requirements.
10.3 The result on microbiological tests as in clause 9.6.2 satisfies the relevant limits.
10.4 The composite sample tested as in clause 9.6.3 satisfies the relevant requirements.

11. Testing methods

The tests shall be carried out following methods described in forth column of tables 2, 3 and 4 and annex A to G.

ANNEX-A

INSPECTION AND ANALYSIS OF FLAVOR, ODOR AND DEFECT

A1 Apparatus
A1.1 Porcelain bowls
A1.2 Stainless steel spoons

A2 Procedure
A2.1 The product shall be inspected by a panel comprising at least 5 judges who are familiar with the factors governing the quality of the product. Each judge shall independently inspect the product and assign scores for deferent characteristics. The scoring system is given in Clause A2.2 and A2.3, respectively.
A2.2 The characteristics given in Table 6 shall be considered for scoring:

Table 6: Scoring for Sensory Test

Item	Full Score
Flavor	20
Odour	20
Defects	20
Total Score	**60**

A2.3 System of Scoring

The scoring of product characteristics shall be based on the classification as given in the Table 7.

Table 7: Scoring System

Score Classification			Inspection item
	Flavor	Odor	Defects
1 – 9	Poor	Poor	Poor
9 -14	Fair	Fair	Fair
14 - 20	Good	Good	Good

ANNEX-B

DETERMINATION OF MOISTURE

B1- Sampling

Collect samples in appropriate quantities from the designated lot. Homogenize each sample to a uniform mass. Transfer to an airtight container to prevent the loss of moisture.

B2- Determination of moisture

Weigh accurately about 5 g of the prepared sample in a moisture dish. Dry in an air oven at 110° C for overnight. Cool in a desecrator. Quickly weigh the dish.

Calculate Moisture as follows.

$$\text{Moisture (\%)} = \frac{M1 \times 100}{M2}$$

Where:

M 1 = Loss in g in the mass of sample

M 2 = Mass in g of the sample taken for test

ANNEX-C

DETERMINATION OF ASH INSOLUBLE IN DILUTE HCL

C1- Reagent

Dilute hydrochloric acid (HCl) -1+1 to 6N

C2- Procedure

Weigh accurately 2 g of the dried material (obtained after determination of moisture) in a crucible. Transfer to a muffle furnace, char at 200°C and keep at 550°C for few hours till grey ash is obtained. Remove after the temperature of muffle furnace drops to around 100°C and cool in a desiccator. Weigh to determine total ash, if desired. Add 25 - 30 ml of dilute HCl to the crucible and boil it for 10 minutes. Cool and filter it through Whatman filter paper No 42 or its equivalent. Wash the residue with water until the washings are free from chloride as tested with silver nitrate. Return the filter paper and residue to the crucible. Dry in an oven at 110°C for overnight and cool and weigh.

C3- Calculation

$$\text{Ash insoluble in dilute HCl (on dry basis)} = \frac{100 \times (M2 - M)}{}$$

M l -M

Where:
M 2 = mass of dish with acid insoluble ash plus filter paper
M = mass of empty crucible plus filter paper
M l = mass of crucible with the dried sample

ANNEX-D
DETERMINATION OF TOTAL PROTEIN (KJELDAHL METHOD)

D1- Reagents

D1.1 Kjeldahl catalyst: - 15gm Pot. Sulphate + 0.5gm Copper sulphate
D1.2 Sulphuric Acid - Concentrated
D1.3 NaOH solution- 50% (1+1). Let stand until clear
D1.4 Standard NaOHsolution-0.1 N=0.1 M (4.00gm/litre)
D1.5 Standard acid solution- Prepare either HCl or H2SO4 solution HCl sol-0.1 N= 0.1 M (3.646gm/litre)
D1.6 H2SO4 sol - 0.1N=0.05 M (4.9gm/litre)
D1.7 Methyl Red Indicator - 0.5gm in 100ml absolute ethanol

D2- Procedure

Weigh 1-1.5 g of prepared sample and transfer to a Kjeldahl digestion flask. Add 15 g of potassium sulphate, 0.5 g of copper sulphate and 15 (use an exact amount) ml of sulphuric acid with one or two boiling chips. Heat the flask gently in an inclined position until froathing ceases then boil briskly for 2 hours. Allow to cool. Add approx 200ml of water and 25ml of sodium thiosulphate solution (80g/L) and mix. Add a piece of granulated zinc or anti bump granules and carefully pour down the side of the flask sufficient sodium hydroxide sol (1+1) to make the contents strongly alkaline (about 110ml). Before mixing the acid and alkaline layers connect the flask to a distillation apparatus incorporating an efficient splash head and condenser. To the condenser, fit a delivery tube which submerges just below the surface of acid solution in a receiving flask and boil until about 150ml of the distillate is collected. Add 5 drops of methyl red indicator and titrate with 0.1N NaOH. Carry out a blank, 1 ml of 0.1 HCl or H2SO4 is equivalent to 0.0014 of N.

% N = [(ml std acid x N of acid – ml blank x N of base) – (ml std base x N of base) x 1.4007]/ sample weight in g

Total protein = N X 6.25

ANNEX-E
DETERMINATION OF TOTAL VOLATILE BASE NITROGEN

E1 Apparatus

E1.1 Laboratory blender (you don't need a meat grinder nor homogenizer for PRAHOC. Blender is enough)
E1.2 Burette, 5 ml, graduated to 0.01 ml
E1.4 Fluted filter, 150 mm, for fast filtering
E1.5 Steam distillation apparatus (see Figure 3 for a diagram of the apparatus)

E2 Reagents

E2.1 Perchloric acid solution, 6 g/100 ml
E2.2 Sodium hydroxide solution, 20 g/100 ml
E2.3 Hydrochloric acid standard solution, 0.05 N, or 0.01 N if an automatic distillation/titration system is used
E2.4 Boric acid solution, 3 g/100 ml
E2.5 Silicone anti-foaming agent
E2.6 Phenolphthalein solution, 1 g/100 ml in 95% ethanol
E2.7 Tashiro's indicator solution: 0.2 g methyl red and 0.1 g methylene blue in 100 ml 95% ethanol

E3 Procedure

The sample should be finely homogenized using a blender. 10 g (±0.1 g) is weighed into the container of a blender, 90 ml of perchloric acid solution (6 g/100 ml water) is added and the sample homogenized for 2 min. The sample is then filtered through a fluted paper or under vacuum. At this stage, the sample solution is stable and can be kept refrigerated (2–6°C) for a week or so.

50 ml of the prepared extract is transferred to a steam distillation apparatus, together with a few drops of phenolphthalein solution (1 g/100 ml 95% ethanol), a few drops of silicone anti-foaming agent and 6.5 ml of sodium hydroxide solution (20 g/100 ml water). Steam distillation is immediately commenced and 100 ml of distillate is collected.

The distillation tube is submerged in a 100 ml solution of boric acid contained in a conical flask and to which 2–3 drops of Tashiro's indicator solution have been added. Distillation is continued for a total of 10 min after which the distillation tube is removed and washed with water, all rinsings are retained in the receiver flask.

The distillate is titrated with standard hydrochloric acid solution (manually or using an automated distillation/titration apparatus). The TVBN concentration is calculated as:

$$\textbf{TVBN (expressed as mg/100 g of sample)} = ((V1 - V0) \times 0.14 \times 2 \times 100)/M$$

Where:
$V1$ = volume of 0.01 ml mol hydrochloric acid solution in ml for sample,
$V0$ = volume of 0.01 ml mol hydrochloric acid solution in ml for blank, and
M = weight of sample in g.

The blank sample is prepared by adding 50 ml of the perchloric acid reagent to the steam distillation unit instead of 50 ml of the sample extract and repeating the steps above.

Quality *Assurance*:

Duplicate analysis should normally be performed with the difference between duplicates being no greater than 2 mg/100 g.

The apparatus and procedure can be checked by distilling solutions of ammonium chloride equivalent to 50 mg TVBN/100 g.