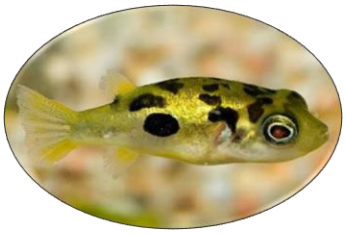
KERALA UNIVERSITY OF FISHERIES
AND OCEAN STUDIES (KUFOS)
Panangad, Kochi, Kerala 682506
www.kufos.ac.in

TECHNOLOGY RELEASE

2022



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MESSAGE

Kerala University of Fisheries and Ocean Studies, a university constituted exclusively for education, research and development, and extension in the fields of Fisheries, Ocean Sciences and allied sectors gives thrust to the development of technologies that could help the state and its farmer/fisher community to promote economic progress and entrepreneurship development. Technology development is the outcome of years of focused research. This publication is a compilation of various technologies developed with the support of the State Plan fund to the University. Additionally, some of the technologies are an outcome of post graduate student research projects and a UNDP funded project during the period 2017-2022. These technologies are ready for transfer to prospective entrepreneurs. The sincere effort taken by our faculty for this is much appreciated.

Dr. M. Rosalind George

Vice Chancellor i/c

KUFOS

15th December 2022

INTRODUCTION

The Directorate of Research of the Kerala University of Fisheries and Ocean Studies (KUFOS) coordinates the research activities of the University. In 2017, with financial assistance from the State Plan Fund, KUFOS established Centres of Excellences in thrust areas of fisheries, ocean sciences and allied sectors, to provide impetus to the fast developments in the fisheries and ocean studies sectors. Various technologies have been developed as an outcome of the research carried out by the faculty during 2017-22, either as part of the activities of the Centres of Excellences or external funded projects or post graduate student projects. Research focusses on indigenous fish seed production, aquaculture feed formulation, aquatic animal health management, aquatic resource management and conservation, fish processing technology and production of value-added food products from underutilised agro-foods and so on. Various aquaculture techniques that have been developed during the period include, seed production of Malabar Dwarf Puffer, Backyard Hatchery Technology for Karimeen and Olive barb, as well as feed products viz. farm made feed for major Indian carps, insect-based feed for pangasius, cashew nut waste-based feed for tilapia. Certain food technological approaches for the development of ready-to-eat products using underutilized and easily perishable crops were viz. bilimbi syrup, jackfruit leather and thermally processed ready-to-eat tomato paste, also low caloric snack products such as marine fibre enriched bakery products, multimillet cookies, nutrient bar, diet chocolate. Fish soup powder using the micronutrient rich indigenous fish silver carplet was developed as a remedy for malnutrition. The nutrient fortification of snacks and ready-to cook food products namely, fish pasta and noodles, calcium incorporated gluten free cookies, shrimp crackers and fish jerky, battered and breaded products from farmed basa as well as seaweed incorporated pasta were developed. Secondary processing and valorization of fish processing wastes for the recovery of value-added product gelatin and their application as a gelling agent for the preparation of marshmallow, jelly and sugar-coated gummy have also been made. An ultra violet assisted vertical recirculatory depuration system was developed to avoid recontamination that help to relay the live shellfishes in the lesser polluted natural water bodies for longer periods.

A brief description on each of these technologies that are ready for transfer to interested entrepreneurs is presented……

15th December 2022

Dr. Devika Pillai
Director of Research

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Kerala University of Fisheries and Ocean Studies

Backyard Hatchery Technology for Karimeen (*Etroplus suratensis*)

Technology developed by

Dr. Binu Varghese*, Thiruvarasu S, Grace George

Department of Aquaculture

Faculty of Fisheries Science

&

Centre of Excellence in Sustainable Aquaculture and Aquatic Animal Health Management

KUFOS

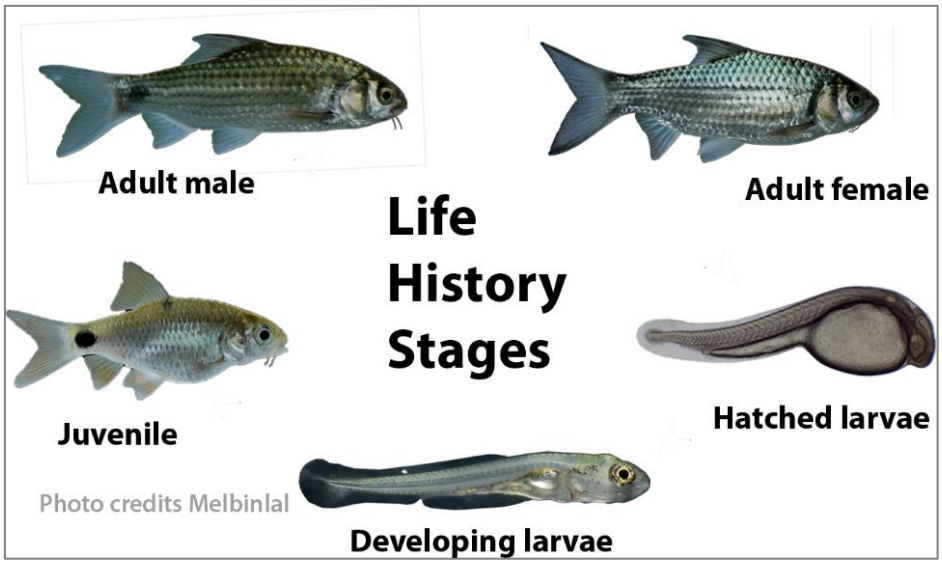
Introduction

Karimeen fishery is in the verge of collapse due to environmental degradation, climate change and destructive fishing practices. Production enhancement can be achieved by conserving resources and reviving aquaculture practices. A viable mass seed production and nursery-rearing technology were developed by KUFOS in 2020. Through proper technological intervention, the status of Karimeen aquaculture can be revived. This will generate viable employment opportunities at various strata like seed production, nursery rearing for the production of fingerlings, cage/pond culture, value addition, and marketing.

Backyard Hatchery for Karimeen

A simplified and easily adaptable backyard hatchery model was developed by KUFOS apart from mass production technology. The backyard system supports production of about 50,000 seeds per annum. The facilities required for backyard hatchery of Karimeen are FRP tanks (brooder, larval and fry rearing), aeration and plumbing system, planter pots (egg attachment), filtration units, shade net/ shelter apart from inputs like fish, feed, water test kits, etc. In this system, fish were provided with one square meter area. The hatchery can produce seeds throughout the year with proper water and feed management and brood care. The eggs or hatchlings were shifted to facilitate repeated spawning.

Backyard Hatchery Technology for the 'Olive Barb' (Kuruva)



Technology developed by

Faculty: Dr. Anvar Ali PH

Student team: Melbinlal, Lovedeep Sharma

Department of Fisheries Resource Management

Faculty of Fisheries Science

Kerala University of Fisheries and Ocean Studies

Introduction

Olive Barb (*Systomus sarana*) is a medium sized native freshwater barb having both food and ornamental value. Once abundant in the flood plain wetlands and low land rivers in Kerala, anthropogenic stress has drastically reduced populations in the wild.

A promising candidate species for: Polyculture with Indian Major Carps and freshwater prawn, stock enhancement in reservoirs and floodplain wetlands (Vembanad-Kole Kaippad and Kuttanad wetlands) and biological eradication of aquatic weeds

Life history information: It breeds at the onset of south west and north east monsoon in Kerala. Lays around 3000 to 6000 eggs on submerged plants. The hatchlings also attach to plant substrata. Initial larval stages feed on zooplankton. Early juveniles and sub adults feed on larval forms of insects.

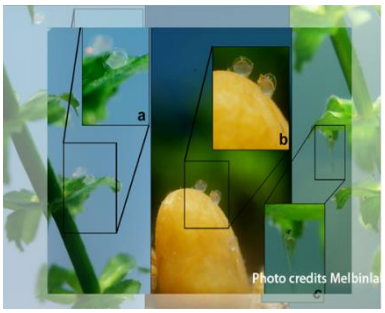
Technology intervention: Broodstock development with supplementary diets. Induced breeding by hormone administration. Provision of spawning substrata. Larval rearing using mixed zooplankton culture (dominated with freshwater copepods). Larval rearing in hapas/ 'green water system'.

Basic Requirements

Small concrete cisterns/FRP tanks/large aquariums/Silpaulin ponds, hormones and accessories, aerators and accessories, spawning substrates, filtration system, nets and accessories, hapas etc. Hands – on training on aspects of farming and seed production essential.

Potential/ Anticipated Beneficiaries: Educated women entrepreneurs, activity groups under self-help groups, members of Kudumbasree Units, educated male youth *etc*.

Beneficiaries, so far: Tribal fisher families in Idamalayar Reservoir catchment, 250 fish farmers in five LSGDs in Munnar Landscape.



Cashew Nut Waste Based Feed for Tilapia

Technology Developed by

Faculty: Dr Chiranjiv Pradhan, Dr T. V. Sankar

Student team: Bala Gopinath Divi, Namitha Dileep, Nikhila Peter

Department of Aquaculture, Faculty of Fisheries Science

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Centre of Excellence in Sustainable Aquaculture and Aquatic Animal Health Management

Kerala University of Fisheries and Ocean Studies

Introduction

The global demand for aquafeed continues to increase in order to support the ever-growing aquaculture industry. There is also an increasing pressure on the traditional protein resources for feed preparation. Soya bean meal (SBM), after fishmeal, is the most expensive ingredient in the fish feed. At the same time, SBM contains certain anti-nutritional factors such as trypsin inhibitor and phytate, which limit the utilization of protein and essential minerals respectively. The higher inclusion level (>40%) of SBM is associated with intestinal problems in many fish species. Therefore, there is a potential need for the replacement of soya bean with other suitable ingredients. Cashew nut meal (CNM) consist of cashew nut processing waste. It contains 35%–40% crude protein and is rich in amino acids such as phenylalanine, leucine, arginine, isoleucine, methionine and lysine. CNM is a potential ingredient for aquafeed formulation.

Feed Preparation

All the plant ingredients were ground to a fine powder and mixed with vegetable oil and vitamin–mineral mix as per the feed formulation (Table 1). The mixture was then compressed into pellets in a semi-industrial pellet machine (meat mincer) using a 1-mm die (Fig. 1). The pellets were dried in a drier at 55°C overnight and fed to the fish.

Table 1: Feed for tilapia

Ingredient	Composition (g/kg)
Soyabean meal	200
Cashew nut meal	400
Ground nut oil cake	230
Maize	50
Rice bran	50
Oil	20
Vit min mix	10
Salt	10
Yeast	10
cellulose	10
CMC	10

Product

The product was developed replacing 50% of soybean meal with CNM in the diet of tilapia. This is an all-plant ingredient based feed. CNM is locally available at a much cheaper price than SBM. CNM appears to be a suitable ingredient at 40% incorporation level along with 20% soya bean meal in the diet of tilapia. In addition, CNM also exhibited the lowest economic conversion ratio in this replacement level.

Fig 1. Different steps of feed preparation

Farm made feed for Indian Major Carps (IMCs)

Technology Developed by

Faculty: Dr Chiranjiv Pradhan

Student team: Nikhila Peter and Namitha Dileep

Department of Aquaculture, Faculty of Fisheries Science

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Centre of Excellence in Sustainable Aquaculture and Aquatic Animal Health Management

Kerala University of Fisheries and Ocean Studies

Introduction

Indian major carps (Catla, Rohu and Mrigal) are the mainstay of Indian aquaculture. In carp culture, the use of commercial feeds is restricted to about 3% only and rest 97% comes as farm-feed prepared by the farmers in India. The use of cakes of edible oil seeds as ingredients is becoming too competitive and costly especially for farm made feed formulations. Depending on needs and affordability, the cake-bran mixture however is further improved with supplementation of nutrient rich newer variety of plant and animal ingredients for enhancing the feed quality. The use of farm made feed and preparation of farm made feed from non-conventional ingredients for small scale aquaculture practice will be a great help for farmers of Kerala.

Feed Preparation

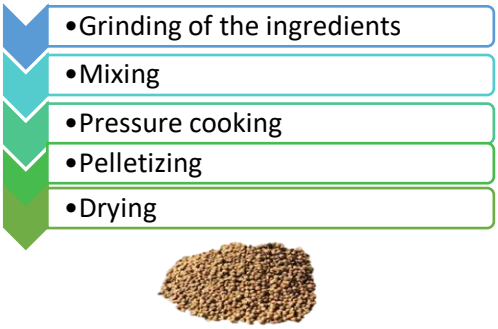

Table 1: Farm made feed for IMC

Ingredients	Composition(g/Kg)
Copra meal	200
Ground nut oil cake	500
Rice bran	270
Vitamin-Mineral mix	10
Tapioca flour	20
Chemical composition	
Crude protein	292
Ether Extract	60.6
Crude fibre	85
Ash	75.2
Nitrogen free extract	497.2

Product

The feed was prepared taking copra meal, groundnut oil cake (GOC), rice bran (RB), tapioca and vitamin and mineral mix (Table 1). The crude protein and lipid level was 29% and 6% respectively.

The feed is suitable for all growth stages of IMC in pond culture condition. Semi industrial pelletizer can be used for the preparation of 3 mm size pellet of this feed for grow out fish. The crumbled pellets of 2mm, 0.5 mm and 50-80µm is suitable for IMC fingerling, fry and spawns, respectively.

Insect based feed for *Pangasianodon hypophthalmus* (Pangasius)



Technology Developed by

Faculty: Dr Chiranjiv Pradhan

Student Team: Ardra M

Department of Aquaculture, Faculty of Fisheries Science

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Centre of Excellence in Sustainable Aquaculture and Aquatic Animal Health Management

Kerala University of Fisheries and Ocean Studies

Introduction

Insect larvae are considered as the most promising and sustainable alternative protein ingredient in aquafeeds due to their high protein content, amino acid profile, fast multiplication and carbon footprint. Black solider fly (BSF: *Hermetia illucens*) is one of the most promising insects and has the ability to bio-convert wide range of organic matter into sustainable protein. The nutrient profile of BSF larvae (BSFL) is determined by the substrate they consume. A BSFL weighs approximately 0.1 to 0.2 grams and contains 42% protein and 35% fat by dry weight. In aquaculture BSFL have been extensively studied, and in many fish species this can partially or completely replace fishmeal from feed.

Feed Preparation

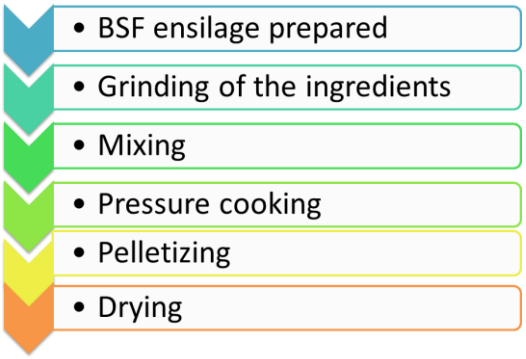

Table 1: Feed for pangasius

Ingredients	Composition(g/Kg)
Ensiled BSF	300
Soy protein isolate	100
Soybean meal	300
Corn flour	120
Wheat flour	150
Vitamin-mineral mix	20
Salt	2
Yeast powder	2
Carboxy methyl cellulose	5
Antioxidant	1

Product

Pangasius feed was prepared by 100% replacement of fishmeal with ensiled BSFL (Table 1). The feed was palatable for Pangasius and contributed to growth of the fish. The body crude protein and lipid were also unaffected by the inclusion of BSFL. The total replacement of fishmeal with BSFL was possible in Pangasius diet. BSFL based feed reduced the overall operational cost of Pangasius farming as well.

Seed Production of Malabar Dwarf Puffer (*Carinotetraodon travancoricus*) Endemic fish of the Western Ghats

Technology Developed by:

Faculty: Dr. Binu Varghese

Student team: Chandana B L, Ashly Sanal

Department of Aquaculture

Faculty of Fisheries Science

Kerala University of Fisheries and Ocean Studies

Introduction

The smallest known puffer species, Malabar dwarf puffer *Carinotetraodon travancoricus*, is endemic to rivers originating from the Western Ghats. It is called Dwarf /Pygmy/Pea Puffer due to its smaller size, which barely reaches more than 30 cm. It is one of the most exported ornamental fish from India and is widely collected from the rivers of Kerala. Increasing demand in global trade has resulted in large-scale exploitation of this fish from its natural habitats. Apart from their size, the most characteristic feature is pronounced sexual dimorphism. Males are usually more brightly coloured and possess erectile ridges along the belly. As per IUCN reports, their population in the wild has declined 30-40% in recent years and is showing a decreasing population trend and has been enlisted under the Vulnerable (VU) category.

Captive Breeding of Dwarf Puffer

The propagation of Malabar Dwarf Puffer was done successfully under captivity. The occurrence of mature individuals in the wild population was reported during June-July and in September-October. The fishes were observed to spawn continuously, sometimes daily, in the artificial breeding environment. The eggs were deposited on the tank bottom in the substrate provided, and the eggs were spherical with an average diameter of 1.4 mm. They were transparent and non-sticky with a pale yellow colouration. The incubation period varied between 96 to 116 hours.

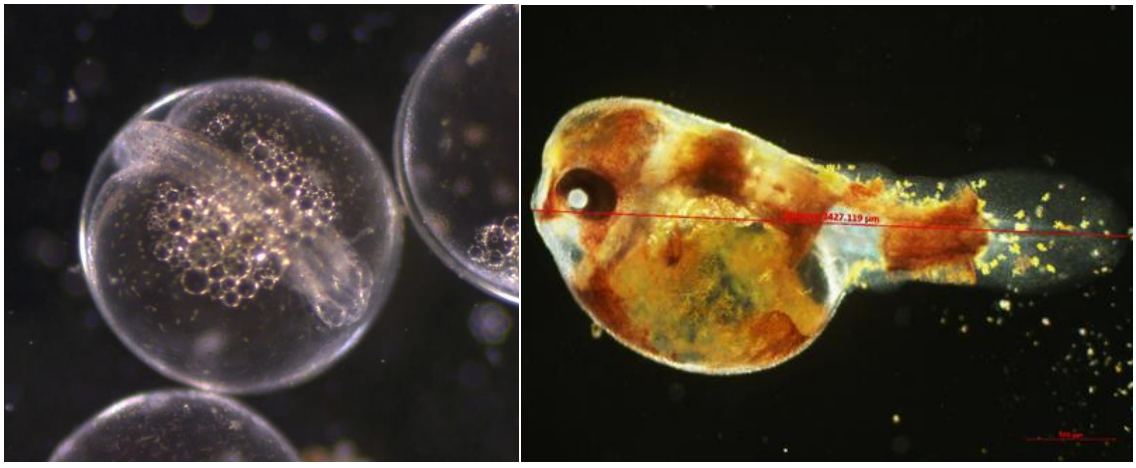

Fig 2. Developing embryo of Dwarf Puffer

The newly hatched larvae had an average length of 3.5 mm and were brightly pigmented with an enormous yolk sac. The larvae were fed with newly hatched Artemia nauplii, Moina neonates, etc initially. As they grow, they were fed with blood worms, frozen Artemia, mosquito larvae, etc.

Acknowledgments

This technology was developed under the KUFOS Aided Research Project (KARP) (DoR/4751/2019 dated 22.6.2019)

Ultra Violet Assisted Vertical Re-Circulatory Depuration System

Technology Developed by

Faculty: Dr. Abhilash Sasidharan,

Dr. Binu Varghese

Student team: Anjana Sunil

Department of Fish Processing Technology,

Faculty of Fisheries Science

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Earn While You Learn Programme

Kerala University of Fisheries and Ocean Studies

Introduction

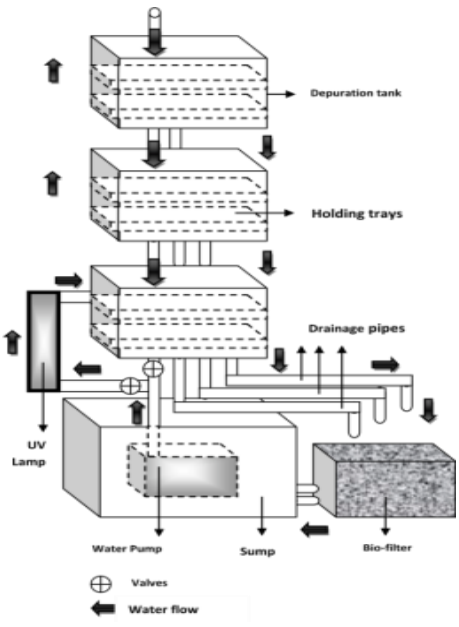
The most effective and reliable approach to producing safer shellfish to the consumer is to grow or harvest them from unpolluted or less polluted water bodies which is practically impossible in current scenario. Harvesting must be then followed by depuration, which is a process of flushing away the waterborne contaminants like pathogens including bacteria and viruses, bio-toxins, and heavy metal from their body by keeping them live in clean water systems and avoiding recontamination or relaying the live shellfishes in the lesser polluted natural water bodies for longer periods.

The Product

KUFOS presents a cost-effective, portable, ultraviolet assisted vertical re-circulatory depuration system which is effective in the reduction of total viable count by 1.8 log cfu g-1, keeping *Escherichia coli* within the permissible limit and making sure both *Vibrio cholera* and *V. parahaemolyticus* are absent.

The concentrations of heavy metals (Cd, Pb and Cu) were found to decrease by 40.44%, 96.51% and 34.50% respectively at the end of 48 h of depuration in UVDC. Significant reduction in protein, lipid, ash and glycogen contents were observed after the depuration process. The portability and easy to assemble nature of the system further improves its applicability as an onsite depuration unit which could be effectively utilized by the small-scale clam fishers/farmers depending on polluted waters for enhancing their income and livelihood.

Processing



Battered And Breaded Products from Farmed Basa (*Pangasius hypophthalmus*)

Technology Developed by

Faculty: Dr Abhilash Sasidharan

Student team: Nino Thomas M

Department of Fish Processing Technology

Faculty of Fisheries Science

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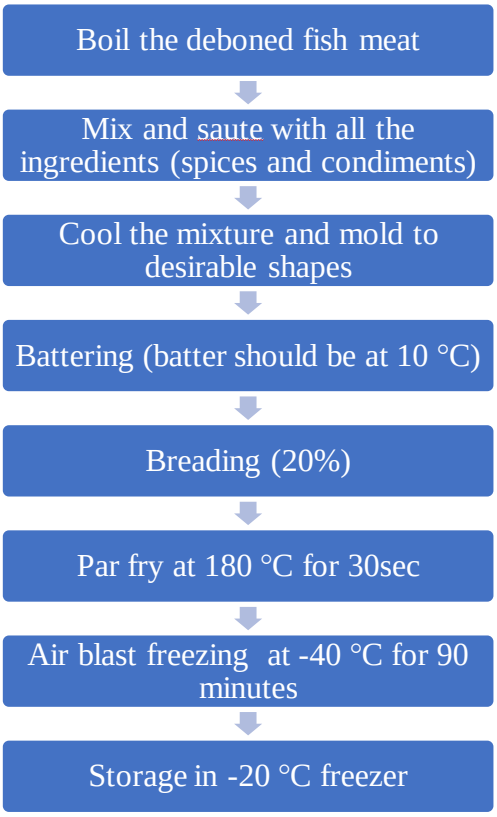
Centre of Excellence in Food Processing and Packaging Technology

Kerala University of Fisheries and Ocean Studies

Introduction

Breaded and battered ready to cook products from Basa fish offers the flavour and crispy mouth-feel that consumers crave. Development of unique value-added products from *Pangasius hypophthalmus* (Basa) like mince-based ready to cook products such as cutlet, finger and balls etc is an excellent tool for efficient market penetration of the Basa fish.

Processing



The Product

These products are simple to prepare and cooks from frozen to fry. These are rich in protein.

Ingredients

Cutlet & Fish Ball: Deboned boiled fish, Potato, Green chili, Ginger, Onion, Pepper, Clove, Cinnamon, Turmeric, Garlic, Jeera, Chili powder, Coriander leaves, oil, Salt.

Batter mix: Maida flour, corn flour, water, salt.

The natural bread crumbs are used for breading. The batter temperature -10 ^{0}C.

Fish Finger: Fish fillets into strips of 1.5 x 11 cm.

Batter mix: Maida flour, corn flour, water, salt.

The natural bread crumbs are used for breading. The batter temperature -10 ^{0}C.

Calcium Incorporated Gluten Free Cookies

Technology Developed by

Faculty: Dr. Blossom K L

Student team: Ligi Jose

Department of Fish Processing Technology,

Faculty of Fisheries Science

Kerala University of Fisheries and Ocean Studies

Introduction

Calcium incorporated gluten free cookies is effective for calcium deficiency and persons who are allergic to gluten protein.

The product is rich in fibre, calcium, phosphorous, magnesium, sodium and potassium and it helps to meet the recommended daily allowance (RDA) for calcium.

Ingredients

- Rice flour
- Quinoa flour
- Calcium powder
- Chocolate spread
- Brown sugar
- Cinnamon
- Egg
- Baking powder

Processing Method

Extract calcium from tuna bone powder

Mix all ingredients together

Resulting dough is sheeted and cut into equal size

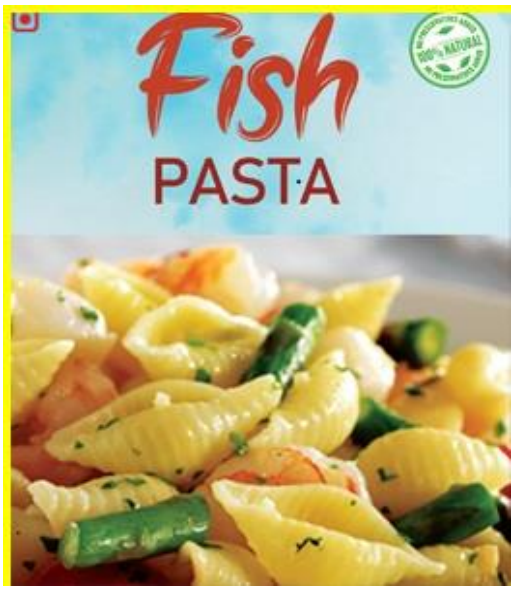
Bake at 180˚C for 15 min

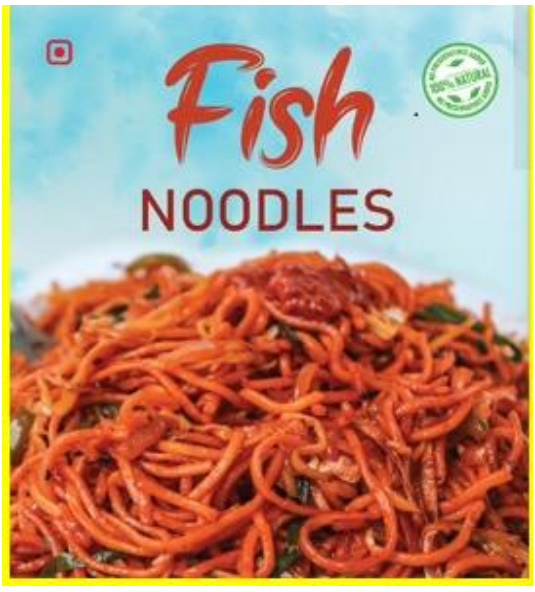
Cool at room temperature for 1 hr.

Nutritional Profile/100g

Protein	: 8.9 g
Carbohydrate	: 73g
Total fat	: 8.7 g
Calcium	: 699 mg
Sodium	: 29.8 mg

Fish Based Pasta and Noodles





Technology Developed by

Faculty: Dr Blossom K L*, Dr T. K. Srinivasa Gopal

Student team: Jisto Mathew

***Department of Fish Processing Technology,**

Faculty of Fisheries Science

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Centre of Excellence in Food Processing and Packaging Technology

Kerala University of Fisheries and Ocean Studies

Introduction

Nowadays due to busy life style, consumers are attracted to RTE and RTC foods.

Pasta products are termed as 'junk food' which do not give much health benefit. In order to make foods more healthy, fortification of foods is done by adding biological active compounds. Fish is an excellent source of high nutritional value protein and an excellent source of lipid.

Ingredients

- Wheat flour
- Fish mince (Tilapia)
- Salt
- Water

Processing Method

Nutritious fish pasta and noodles are prepared by incorporating 30% tilapia mince with wheat flour and are mixed and extruded in single screw extruder. The product is then dried to 30% moisture content. The product is packed in polythene bags, labelled and stored.

Nutritional Profile

- Protein - 17.15%
- Fat - 0.744%
- Shelf life - 90 days

Fish Jerky

Technology Developed by

Faculty: Dr. Shyni K

Student team: Ahana Vijayan, Bala G, Vishnupriya V, Anandakrishna, Dayal K

Department of Fish Processing Technology

Faculty of Fisheries Science

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Model Fish Processing plant and Training Centre

Kerala University of Fisheries and Ocean Studies

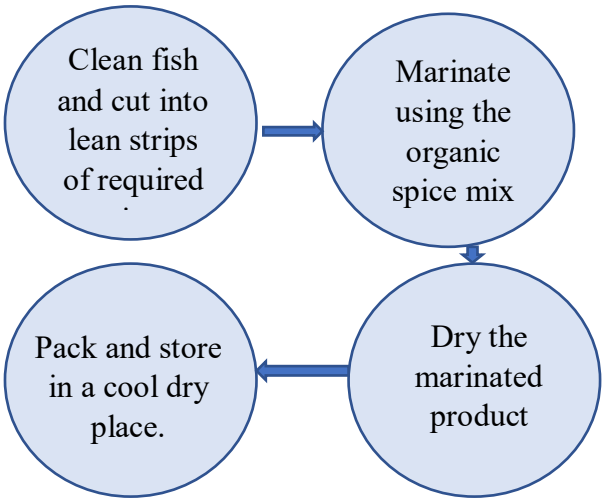
Introduction

Dried fish always wins the market as the fresh one deteriorates rapidly unless we find a way to preserve it. Fish jerky is one among the dried product in which the fish meat is cut into lean strips and are marinated using organic spice mix and are dried. Jerkies can be eaten as such or can be fried and consumed. These are high in proteins and omega-3 fatty acids with a very little fat. Thus, fish jerkies is found to be a delicious snack that offers a wealth of nutritional benefits. The product should be kept in cool, dry place preferably in the refrigerator. Fish jerkies should be consumed within 6 months from the date of manufacture and once opened it should be stored air tight and keep refrigerated.

Ingredients

- Tuna fish
- Organic spice mix

Process flow



Nutrition profile

Carbohydrate : 11 gms
Protein : 9 gms

Fish Soup Powder Using Silver carplet

Technology Developed by

Faculty: Dr Devika Pillai, Dr. T. K. Srinivasa Gopal

***Student team*: Rabea Naz H, Gopika P J, Ammu Dinakaran, Dr Divya K Vijayan**

Centre of Excellence in Food Processing and Packaging Technology

Kerala University of Fisheries and Ocean Studies

Introduction

Silver carplet (*Amblypharyngodon meletinus*) is a small indigenous nutrient dense fish, an excellent source of micronutrients such as iron, zinc, calcium, vitamin A and vitamin B12, as well as fatty acids and animal protein. Its utilization can be a perfect remedy for malnutrition. Soup is a nutritious liquid meal with high nutrient density with a low energy density. Hence the development of soup powder using the whole silver carplet fish ensures micronutrient availability and contributes to its value addition.

Ingredients

- Silver carplet fish
- Tapioca flour
- Onion
- Butter
- Salt
- Sugar
- Coriander powder
- Pepper
- Carboxy methyl cellulose
- Ascorbic acid
- Milk powder

Processing

- Wash the beheaded fish with 1% sodium bicarbonate solution
- Steam cook at for 10 min. Blend with fried ingredients to make it a thick fine paste
- Dry the whole mass in aluminum trays at 55 °C.
- Powder well to get a homogenous product.
- Soup powder is packed in airtight flexible pouches.

The Product

The ready-to-cook fish soup powder was vacuum packed in polyester polyethylene laminate packets. It can be stored for more than three months at room temperature.

Jelly

Technology Developed by

Faculty: Dr. Radhika Rajasree S.R

Student team: Neha P Nair, Zuhara Muhammed Hussain, Fathima Asharaf, Jamshi J, Nandhu G, Roopa Rajan

Department of Fish Processing Technology

Faculty of Fisheries Science

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Centre for Advanced Studies and Research in Entrepreneurship Development in Fisheries, Agribusiness and Allied Sectors

Kerala University of Fisheries and Ocean Studies

The product

Jelly is a class of sugar confectionery based on a hydrocolloid that is prepared by boiling a clear solution of fruit juice or fruit flavour that beneficial for human health. It is sticky textured and transparent shaded with a sweet chewy consistency.

The uniqueness of the product is the incorporation of fish gelatin, a versatile hydrocolloid as the gelling agent. Despite of utilizing fishery discards for gelatin production, it provides an effective way to overcome problems, such as health and religious issues that might arise from the consumption of gelatin obtained from the mammalian sources.

Nutritional fact (g/100g)

- Energy : 255.2 Kcal
- Protein : 3.6g
- Carbohydrate : 60.2g
- Fat-0 g

Ingredients

- Fish Gelatin
- Water
- Sugar
- light corn syrup
- Vanilla essence
- Food colour (permitted synthetic food colour)

Process flow

- Take a pan, add 1 cup of water, add approx. ½ cup of sugar to it and boil it for 3-4 minutes
- Take 2-2.5% fish gelatin and add it to lukewarm water, keep it aside till it become spongy
- Once the sugar reaches a boiling stage of thread like consistency, add the fish gelatin into the sugar syrup, add 1-2 drops of fruit flavour and 2 drops of food colour to the mixture, mix well
- Pour the mixture into mould to get desires shape and keep it for 2-4hrs and after that demold it

Marshmallow

Technology Developed by

Faculty: Dr. Radhika Rajasree S.R

Student team: Fathima Asharaf, Neha P Nair, Zuhara Muhammed Hussain, Jamshi J, Nandhu G, Roopa Rajan

Department of Fish Processing Technology

Faculty of Fisheries Science

&

Centre for Advanced Studies and Research in Entrepreneurship Development in Fisheries, Agribusiness and Allied Sectors

Kerala University of Fisheries and Ocean Studies

The product

Seafood processing is an important economic activity worldwide. However, it results in bulk solid waste generation whose disposal and management are a serious concern. Secondary processing and valorization for recovery of value-added products such as gelatin seems as better alternative to this.

Fish gelatin, a multifunctional ingredient possesses an excellent whipping property, used for the formation of foam in marshmallow. Marshmallow, an aerated confectionery product is very popular among kids because of unique textural properties and mouth- feel. The incorporation of gelatin provides a spongy structure and enhances the protein content of marshmallow and increased acceptability.

Nutritional fact (g/100g)

- Energy- 254.4 Kcal
- Protein- 3.4g
- Fat-0g
- Carbohydrate- 60.2g

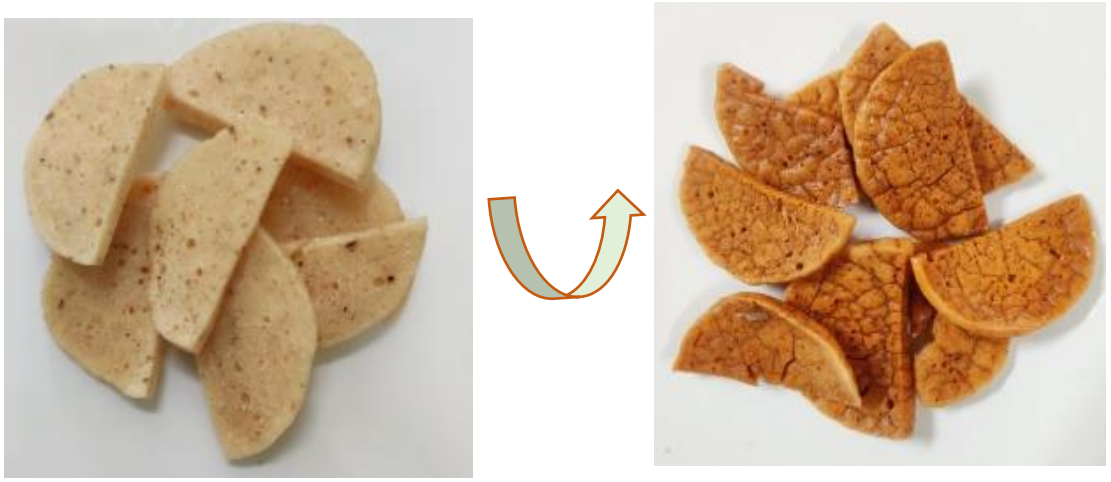
Ingredients

- Fish Gelatin
- Sugar
- Light corn syrup
- Vanilla essence
- Corn starch/Corn flour- mix with icing sugar
- Water

Process flow

A solution is formed by dissolving sugar and corn syrup in water and boiling it and fish gelatin is mixed with the sugar solution. Then the ingredients are heated and passed through a strainer to remove extraneous matter. The mixture is then beaten into foam to two or three times its original volume. At this stage, flavouring can be added. The mixture is then placed in a mould, cooled, cut and dried. A coating of corn starch is added to counter stickiness and help maintain their form.

Shrimp Cracker



Technology Developed by

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Faculty of Fisheries Science

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Model Fish Processing plant and Training Centre

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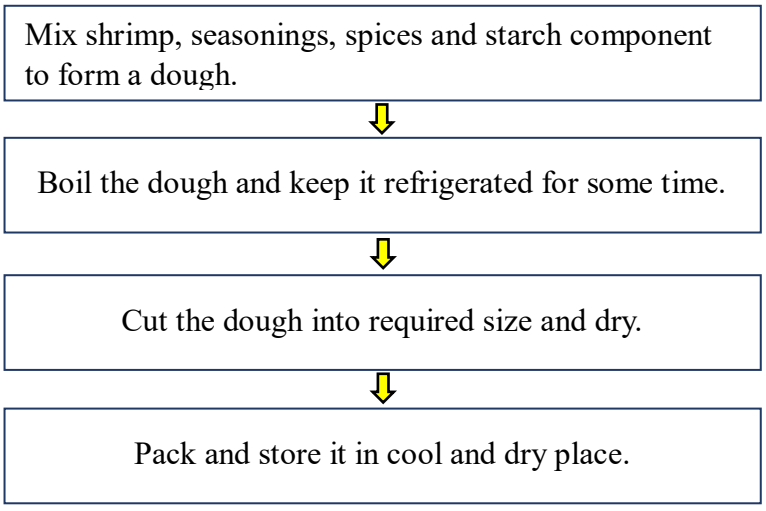
About the Product

In our modern era the demand for snack foods is increasing day by day. Crackers are often branded as a nutritive and convenient way to consume a staple food, especially among the younger and middle aged groups. Crackers are dried products which can be fried and eaten and also accompany other food items such as cheese, jam, butter etc. The carotenoids rich shrimp cracker was developed using shrimp as the base material along with organic spice mixes and a starch component. The combination of shrimp with organic spices without any added preservatives results in greater antioxidant properties and excellent shelf life. The crackers are relatively rich in proteins, vitamins & minerals and a great source of carbohydrates. The product should be kept in cool, dry place and should be consumed within 4 months from the date of manufacture. Once the pack is opened crackers should be used within one week.

Ingredients

- Shrimp
- Organic spice mix
- Starch component

Process Flow



Nutrition Profile

Energy : 140 kcal

Carbohydrate : 18 g

Protein : 2 g

Fat : 5 g

Seaweed Pasta

Technology Developed by

Faculty: Dr. Radhika Rajasree S.R

Student team: Roopa Rajan

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Faculty of Fisheries Science

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The product

Malnutrition is the leading cause of immunodeficiency in the world, affecting primarily children, adolescents, and the elderly, making them more susceptible to infections. Application of seaweed based nutritional food is a viable current alternative to overcome this since seaweed cuisines are considered as highly valuable foodstuff around the globe, because of their nutritional importance.

Pasta is considered a healthy food being relatively low in fat, high in carbohydrate, and with good protein content. Nutritional improvement of pasta mainly involves increasing protein and dietary fiber content and the fortification with vitamins and minerals.

The addition of abundantly available seaweed as an ingredient in wheat pasta will enhance the nutritional profile of traditional pasta formulations with significant health benefits for all age groups.

Nutritional fact (g/100g)

Energy	:	234 kcal
Fat	:	0.013g
Protein	:	3.442g
Carbohydrate:		55.31g
Crude fibre	:	3.08g

Ingredients

- Wheat flour
- Seaweed (Ulva reticulata)
- Salt
- Water

Process flow

- Mix wheat flour, seaweed extract and salt together in a pasta extruder machine
- Adjust the water level such that it favors fine extrusion of the product.
- Fix the dye of desirable shapes and start extrusion.
- Pack in sealed containers or pouches and store in cool and dry place.

Sugar Coated Gummy

Technology Developed by

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The product

Fish gelatin is a derivative product from the hydrolysis of collagen contained in the bones and skin of animals. It has a thermo-reversable gel formation ability and “melt in mouth texture”, thus it acts as an active agent in the formulation of jelly-based confectioneries.

Sugar coated gummy is a fish gelatin based chewable sweet with food acids such as citric acid or mallic acid in order to give a tart flavour. They are characterized by a nice and delicate texture. It is coated with sugar, thus increases then shelf life, elastic and chewiness which bring wonderful mouthfeel.

Nutritional fact (g/100g)

- Energy : 330.8Kcal
- Carbohydrate : 80g
- Protein : 2.7g
- Fat : 0g

Ingredients

- Sugar
- Fish gelatin
- Fruit flavour
- Permitted food colour
- Citric acid
- Water

Process flow

- A solution is formed by dissolving sugar and corn syrup in water and boiling to Firm ball stage (242 - 248˚F).
- Gelatine is added at this stage and cooked for 1 – 2mins and flavorings and colours are added.
- The jelly mixture is poured into a starch mold or a plastic mold, and solidified.
- The jellies are then coated with layer of powdered sugar.

Bilimbi Syrup

Technology Developed by

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Introduction

Bilimbi is a fruit that is largely cultivated in Kerala and is available in plenty but it does not have any market value or even does not have a place in the market despite its medicinal properties. In view of this an effort has been made to develop a value-added produce. Pasteurised bilimbi syrup using fresh bilimbi extracts. There are reports that can be evidenced for the use of bilimbi fruit for medicinal purposes. The fruit syrup is used for treating fever and inflammation, coughs, beri-beri, to stop rectal bleeding and to reduce the severity of internal hemorrhoids

The Product

The syrup is acidic with TSS (68° Brix) in accordance with FSSAI Standards. The product was packed in polypropylene bottles and stable at room temperature for 10 months

Ingredients

- Fresh ripe bilimbi
- Sugar
- Potassium metabisulphite

Processing

- Cut fresh bilimbi fruits into small pieces
- Steam cook the fruit along with water (1 part water:6 parts Bilimbi)
- Extract the juice
- Add sugar syrup (80 °B) and potassium metabisulphite
- Pack in clean and sterile bottles
- Pasteurization of the syrup filled bottles

Fibre-rich Biscuits

Technology Developed by

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Student team: Ninisha Babu, Gopika P J, Ammu Dinakaran, Dr Divya K Vijayan

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Introduction

Biscuits, a flour-based baked food products are widely accepted bakery product due to its ready to consume nature, nutritional consistency and availability in various varieties and reasonable price.

Carrageenan is a natural polysaccharide obtained from red seaweeds and is a rich source of fibre. The diets rich in fibre have a positive effect on health, thus, carrageenan was incorporated into biscuits to enhance the fibre content.

Ingredients

- Refined flour
- Carrageenan (food-grade)
- Oil
- Sugar
- Salt
- Skim milk powder
- Emulsifier
- Sodium bicarbonate Ammonium bicarbonate
- Invert syrup
- Essence

Processing Method

- Dough preparation
- Leavening for 30 minutes of dough
- Molding
- Baking

Product

Biscuits incorporated with marine fiber carrageenan was developed and found to have better nutritional characteristics, antioxidative properties and consumer acceptability. Incorporation of 6% carrageenan was found to be ideal for improved fiber content and consumer acceptability. The biscuits are packed in polypropylene cups and exhibited shelf life of the 56 days at room temperature.

Diet Chocolate

Technology Developed by

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Introduction

Chocolate is a very popular food product that is relished by millions of people for its unique, rich and sweet taste. The health benefits of chocolate are immense which is attributed to its high levels of antioxidant components. Dark chocolates are consistently associated with better physical health, body composition and are recommended to have short-term benefits on reducing blood pressure, lower blood cholesterol and lower the risk of cardiovascular disease. It is also considered as mood enhancer and improves cognitive performance.

Processing

- Melt cocoa butter substitute
- Mix cocoa powder, milk powder, lecithin, sweetener and jackfruit seed powder
- Mix thoroughly and pour into chocolate mould
- Keep under refrigeration to solidify

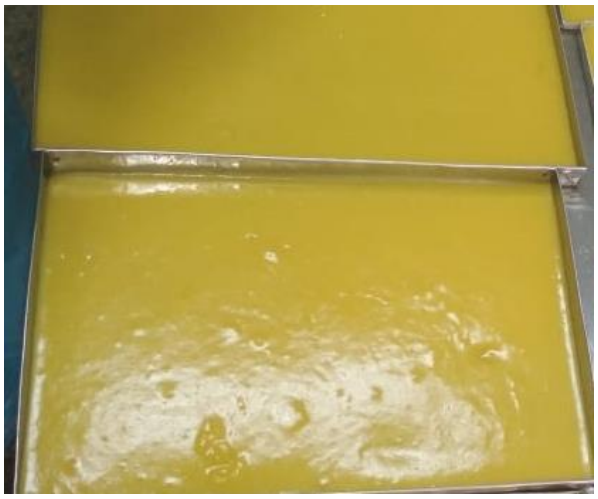
Ingredients

- Cocoa powder
- Jackfruit seed powder (fermentation of whole jackfruit)
- Cocoa butter substitute
- Milk powder
- Lecithin
- Sweeteners: Stevia

The Product

Chocolates are prepared by ten percentage replacement of cocoa powder with jackfruit seed powder facilitate the utilization of the under-utilized jackfruit. The chocolates have a low glycemic index and low glycemic load. Hence, it can be a great substitute for chocolates to diabetic patients. The products were highly accepted by the sensory panel members. The product was packed in metallized polyester laminated with polyethylene pouches at room temperature. Shelf-life of the product is three months.

Jackfruit Leather



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Introduction

Post-harvest loss is very common in seasonal fruits due to its high perishability even under refrigerated conditions. Value addition and processing is the best solution to overcome this problem and it also ensures the availability of the product round the year. The ripened jackfruit is naturally sweet in taste is being used for many traditional preparations in the southern states of India. The fruit bulbs are also eaten as such. It is also found in the markets of Southeast Asia. Fruit leather is a dehydrated product prepared out of fresh fruit pulp or fruit juice concentrate. It is a leather like sheet and is also known as fruit bar or fruit slab.

Packaging

The product was packed in polyester laminated with Biaxiallly oriented polypropylene packets. The shelf life of the product was three months at room temperature, stored in both packaging materials.

Ingredients

- ▶ Jackfruit (*Artocarpus heterophyllus*)
- ▶ Corn flour
- ▶ Honey
- ▶ Water
- ▶ Preservative

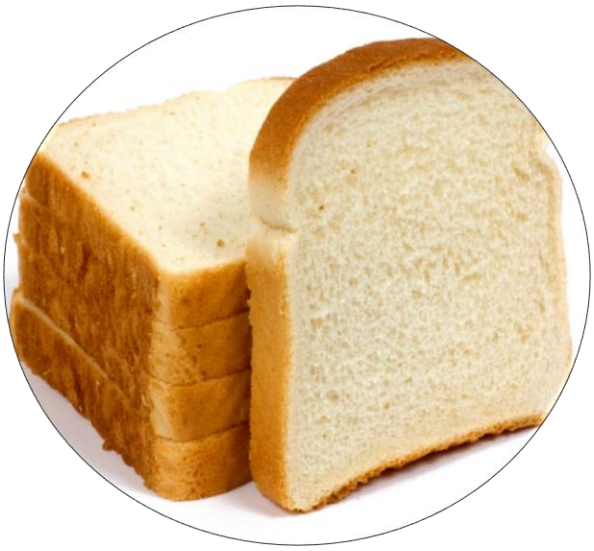
Processing

- ❖ Pressure cook the fruit bulb along with corn flour and water.
- ❖ Grind the fruit along with honey to get smooth pulp
- ❖ Preservative in the permissible level
- ❖ Spread the pulp on trays coated with butter and dried at 52°C and 1.5m/s air velocity for 24h in a tray drier

The Product

Jackfruit leather is a nutritious energy-rich product that ensures availability during off-seasons. This is a high carbohydrate (78.3g%) product, rich in minerals (potassium, sodium, magnesium, calcium); and was widely accepted by the sensory panel members.

Marine- Fiber Rich Bread



Technology Developed by

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Introduction

Bread and bun are the oldest and most popular functional foods all over the world; even though, in India, it is a secondary staple food. Nutritionally, it is a good source of fibers, minerals and vitamins. It has gained considerable attention due to its nutritional and health benefits. κ-Carrageenan, a marine hydrocolloid, is a common food additive extracted from red algae. Even though, it adds no nutritional value or flavor to the food, it finds wide application in the food industry. It serves as a substitute for fat and acts as thickening, gelling and stabilizing agent. In the bakery industry, it has been reported to improve the dough stability and affects the bump area.

The Product

Developed fibre-rich bread using the marine fibre carrageenan and The bread was packed in LDPE pouches.

Major ingredients

- Flour
- Yeast
- Sugar
- Salt
- Oil
- Milk
- Vitamin C
- Carrageenan
- Water

Method processing

- Dough preparation
- Fermentation of dough
- Molding and proofed
- Baking.

Multimillet cookies

Technology Developed by

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Student team: Ninisha Babu, Ammu Dinakaran, Gopika P J, Anupriya E A, Dr Divya K Vijayan

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Introduction

The growing demand for healthy foods has promoted the development of a variety of high fibre, low-sugar bakery items such as bread, cookies, and cakes. Incorporation of Palm jaggery the natural sweetener as well as multi-millet flours helps to improve the health benefits of cookies with very low glycaemic index, high levels of protein, fibre and various minerals. Ragi and sorghum are gluten free. Curcumin, a natural antioxidant, make the product capable to diminish effect of lifestyle induced oxidative stress. Carrageenan is a marine algae polysaccharide also improves the fibre content.

Product

- ❑ Protein rich (10.38%)
- ❑ High anti-oxidant activity
- ❑ Improved fiber content (2.36%)
- ❑ Low glycemic index

Ingredients

- Whole wheat flour
- Ragi flour
- Sorghum flour
- Carrageenan powder
- Curcumin
- Fat.
- Palm jaggery
- Baking powder
- Baking soda

Processing Method

- ► Mixing the fat and ground palm jaggery to make a fine creamy paste.
- ► Dough preparation using dry ingredients with the creamy paste of fat and palm jaggery
- ► Knead lightly to make sure its uniformity
- ► Moulding & Baking.

Packing

The cookies are packed in polypropylene cups and exhibited shelf life of the 9 weeks at room temperature.

Nutrient bar

Technology Developed by

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The Product

In our modern fast paced lifestyle, frequent snacking alternatives are of great demand that can replace the traditional meals. The Nutrient rich high protein bar was developed using pumpkin seed, ground nut, watermelon seed, and chia seed with palm jaggery as natural sweetener. The combination of seeds makes them low in calorie with significant levels of dietary protein, good fat (mono and polyunsaturated fats), zinc, magnesium, potassium, Iron, vitamin B2 (riboflavin) and folate. Also, they are rich source of powerful antioxidants. Palm jaggery was used as sweetening agent that helps to lower the glycemic index of the product.

The product is vacuum packed in 12-micron polyester laminated with 300-gauge polythene. The shelf life of the products was monitored to be more than 8 weeks at room temperature.

Ingredients

- Palm jaggery
- Chia seeds
- Watermelon seeds
- Groundnuts
- Pumpkin seeds

Processing Method

- Roast the seeds in a pan.
- Mix the roasted ingredients with hot palm jaggery syrup in the pan
- Spread uniformly in a tray
- Allow it to cool and cut into pieces

Thermally Processed Ready-To-Eat Tomato Paste

Technology Developed by

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Kerala University of Fisheries and Ocean Studies Panangad, Kochi

Introduction

Tomato is an important vegetable with high commercial value. It is a rich source of Vitamin C, carotenes and other nutrients. Tomato is a seasonal crop due to which it is produced in large quantities during the harvest season and thus a huge load of the raw material arrives at the processing industries. This forces the manufacturer to process in high volumes into various products since it is highly perishable in its fresh state. This has led to the need for processing of tomato into different products in order to extend the shelf life and ensure its availability round the year also to reduce post-harvest loss. Retort processing is a thermal preservation technique which is used for the production of ready to eat processed food products in retortable pouches that are shelf stable at ambient temperatures.

Ingredients

- Tomato
- Garlic
- Chili powder
- Oil
- Mustard
- Asafoetida
- Turmeric powder

Processing

- Heat oil in a pan and pop mustard seeds, black gram and red chilly
- Saute chopped garlic vacuum sealed and stored in freezer (-20 °C.
- Add finely sliced tomato and cook until form a thick paste
- Fill the curry in see through retort pouch and Vacuum seal
- Thermal processing

The Product

The paste developed was filled in sturdy retort pouches, vacuum sealed and thermally processed (121.1°C) using steam-air retort. The F_0 value was determined to be 7.34 min. This commercially sterile product was greatly accepted by the sensory panel members. The product can be kept at room temperature for longer duration without refrigeration and without adding any chemicals.