



## Use Of Pesticides Or Harmful Substances In Fish Drying: A Study On The Coast Of Purba Medinipur District, West Bengal

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### Abstract:

Fishing is one of the major livelihood activities of traditional fishermen in the coastal region of Purba Medinipur district in West Bengal. Most of these traditional fishermen are lower-caste Hindus. In the traditional caste hierarchy, these traditional Hindu fishermen face various kinds of discrimination and unlawful activities. Poverty is their common feature. A large number of traditional fishermen depend on the traditional petty trade of fish drying. Earlier, they used only traditional technologies and did not depend on harmful substances (especially various pesticides or insecticides) to dry or preserve fish in a short time. Recently, the technology and methods of drying fish have changed a lot for fishermen in coastal regions. Nowadays, traditional fishermen often use various harmful substances such as pesticides or insecticides to dry the fish quickly, to preserve it for a longer period and to dry it during the rainy season or in other humid climatic conditions. Most of these substances have serious health impacts. The present work attempted to determine the health impacts of fish drying workers who work in khoti areas (fish drying centres where fishermen are engaged in fish drying) and are involved to some extent in this chemical-driven fish drying process. The study was conducted among the traditional fishermen engaged in fish drying and petty trading in different khoti areas of Purba Medinipur district in West Bengal. It is mainly a field observation-based work in which various traditional methods of fieldwork were used with due importance.

**Keywords:** Pesticides; Harmful substances; Health impacts, Fish drying; Traditional fishermen; Purba Medinipur coast

### INTRODUCTION:

Dry fishing is an age-old activity of the traditional fishermen of our country. Especially in West Bengal, Purba Medinipur is one of the most important areas for dry fish production. Along the coast of Purba Medinipur, about 42 khoties are in operation year after year till date [1]. More than 50% of these dry fishes are processed by traditional fishermen. Several factors play a crucial role for the khoti people (the people who are attached to Khoti for different purposes) in different areas, especially in the coastal regions. A holistic understanding of livelihoods is required to understand the complexity of the coastal and marine livelihoods. It is done in different situations, especially in the coastal areas of West Bengal where there are marked contrasts in livelihoods of different traditional castes and communities within the region and even from area to area. To generate better income, earn more profit and dry the marine fishes smoothly, they generally used various traditional practices and technologies [2, 3]. In the past, they used only traditional techniques and did not use harmful substances (especially various pesticides or insecticides) to prepare or preserve dried fish in a short time. Recently, the technology and methods of drying fish have changed a lot for fishermen in coastal regions. Nowadays, fishermen often use various harmful substances such as pesticides, insecticides or chemical compounds for quick drying, better long-term preservation and drying during the rainy season or under other humid climatic conditions [4]. Most of these compounds have serious health effects.

### OBJECTIVES:

The present work attempted to determine the health effects of workers engaged in khoti (fish drying centres where fishermen are engaged in fish drying) who is involved to some extent in this chemical-intensive fish drying process. The study was conducted among the traditional fishermen engaged in fish drying and dry fish trading in different khoti areas of Purba Medinipur district in West Bengal.

### METHODOLOGY:

In the present study, an attempt was made to conduct the study in the khoti areas (fish drying centres where fishermen are engaged in fish drying and which are located near the sea or river mouth) of Purba Medinipur district in West

Bengal. The study is mainly concerned with the impact of the use of pesticides or chemicals in fish drying on the khoti workers depending on the season.

Data was collected from adult male and female khoti workers exposed to various harmful substances (pesticides or insecticides) during the fish drying process. Personal observations and prior knowledge of the situation on the ground were very helpful. Interviews, surveys, FGDs and case study-based information were included with great importance. A short structured schedule was used for data collection, especially to understand the process of fish drying in the study areas and to record the impact of harmful substances (pesticides or insecticides) on the khoti workers who regularly come into contact with these substances. The data was collected manually by the researchers.

#### Study area:

The said study was conducted mainly in the coastal and riverine areas (Contai I and II and Ramnagar II block) of Purba Medinipur district. In the present study, no detailed socio-economic surveys or field research was conducted among the fishermen in the said areas, but the main focus was on the use of harmful substances (pesticides or insecticides) in fish drying and their health impacts on the khoti workers. No laboratory-based biochemical studies or experiments were conducted. The main focus was on the analysis of primary data collected from the selected field.

#### Sample size:

During the said study, the authors were on the road a lot. Nearly 110 households were randomly selected for the study, especially those who are currently engaged in some form of dry fishing-related activities and are consciously or unconsciously using harmful substances (pesticides or insecticides). A total of 110 men and women belonging to this category were selected for the study. Of this study population, 61 are male and 49 are female khoti workers. In the selection process, care was always taken to ensure that a study participant (khoti worker) was either a male or a female from one household. Purposive and random sampling techniques were used in the selection of the study sites and study population to avoid some basic problems.

#### Fish used as dried fish in the khoties

In the khoties, dried fish is used for two main purposes.

- Dried fish is used as food for people.
- Dried fish is used as fish meal (food for animals and fish).

#### Dried fish is used as human food

Dried fish or sutki-mach is popular among many people at home and abroad as one of the most important and delicious foods in their daily diet.

**Table - 1:** Commonly used dried fishes in the coastal region of West Bengal

Sl. No.	Species	Scientific name
1	<i>Chital</i>	<i>Notopterus chitala</i>
2	<i>Phasa</i>	<i>Setipinna phasa</i>
3	<i>Khayra</i>	<i>Gadusia chapra</i>
4	<i>Chela</i>	<i>Chela cachius</i>
5	<i>Salted tangra</i>	<i>Mystus sp.</i>
6	<i>Pangas</i>	<i>Pangasius Pangasius</i>
7	<i>Aar</i>	<i>Mystus aor</i>
8	<i>Bela</i>	<i>Glossogobius giuris</i>
9	<i>Chanda</i>	<i>Chanda roma</i>
10	<i>Khalsa</i>	<i>Colisa fasciata</i>
11	<i>Bomla</i>	<i>Harpaclon nehereus</i>
12	<i>Pomfret</i>	<i>Pampus argenteus</i>
13	<i>Hilsa shad</i>	<i>Tenualosa ilisha</i>
14	<i>kari chingri</i>	<i>Metapenaeus monoceros</i>
15	<i>Rupapatia</i>	<i>Trichiurus savala</i>
16	<i>Gangmourala</i>	<i>Stolephorus indicus</i>
17	<i>Bhola</i>	<i>Raiamas bola</i>

(Source: Field data)

Digha Mohana, Sankarpur, Jaldha, New Jaldha, Dadanpatrabar, Junput, Petuaghat, Haripur, Saulya and the neighbouring dried fish processing centres of Purba Medinipur coast in West Bengal and various fish drying centres of the state of Orissa are the major sources of dried fish, which are usually auctioned in the Egra Regulated Dried Fish Market. These dried fish are later sold in various markets in neighbouring states such as Tripura, Sikkim, Nagaland, Manipur, Mizoram, Arunachal Pradesh, Assam, Orissa, Bihar and Jharkhand, as well as abroad, especially in Bangladesh, Nepal, Thailand, Japan and some other South-Asian countries [5,6].

### Traditional methods of drying:

Some researchers [7] found that fishermen were not interested in using red pepper and turmeric powder (with pesticidal effects) because they reported that the spices changed the original colour of the dried fish (sutki mach or suka) and consumers were also not interested in these fish. In the areas studied, traditional fishermen used cooking salt or NaCl to prepare dried fish or sutki mach. Sometimes it is colloquially called laban suka/ nona suka. The common tradition of drying fish in Purba Medinipur district is that traditional fishermen first soak the fish in salt water. The amount of salt depends on the type of fish. Generally, 30-40 kg of common salt (NaCl) is mixed with 100 kg of fish. The salted fish are stored for about 4 to 5 hours before being taken to different drying facilities [8]. The different types of traditional fish drying methods used by the traditional fishermen of the district confirm the findings of similar practices in different parts of India [9-15]

### Processing time

The time chosen to prepare dried fish generally varies from fish to fish. In good weather, especially full sunshine, it takes 4-5 days to dry the fish. In the natural process, it takes longer to dry fish like bomla (*Harpaclon nehereus*), kokila (*Xenentodon cancila*), chakla (*Eleutheronema tetradactylum*), kanta (*Arius thalassinus/ Arius jella*) etc. Drying of fish like various types of chingri, ruli (*Coilia dussumierii*), firka (*Pampus argenteus*), rupapatia (*Trichiurus savala*), phesa (*Setipinna phasa*), gang mouralla (*Stolephorus indicus*) etc. takes comparatively less time. Chingri-suka (dried prawn) is prepared in a very short time while drying fish like chela (*Chela khujairokensis/ Chela cachius*), magrel/ mackerel (*Scomber scombrus*), kanta (*Arius thalassinus/ Arius jella*), bomla (*Harpaclon nehereus*) etc. takes more time. They buy fish for drying 8-10 times a month.

### Suitable weather for drying fish

The entire processing of dried fish mainly depends on dry and sunny weather. Low humidity always favours the production of high-quality dried fish. Thus, in winter, the fish is dried very quickly as the humidity remains at a minimum level. During the Uttara season (when the north wind blows), the sky is cloudless and sunny, the scorching rays of the sun remain present, and the dried fish produced are of good quality. During the Dakshina season (wind from the south), the fish cannot be dried well, although the weather remains good and sunny. Therefore, the months of Ashwin, Kartik, Agrahayan, Poush and Magha are ideal for drying fish [16].

### Use of harmful chemicals/pesticides in khoti activities:

In many khoties of Purba Medinipur district, harmful chemicals, pesticides and preservatives are used in processing dry fish. They use various chemicals and pesticides to dry the fish easily and maintain good quality, especially in rainy, cloudy or bad weather. These chemicals are used to keep the dried fish in good condition and protect it from worms and insects. However, in Junput Khoti, few workers have used insecticides for long-term storage and to prevent blowfly infestation in dried fish. The best-known of these is chlorpyrifos 20 EC [17]. Chlorpyrifos is a white, crystalline or irregularly flocculated solid. It has a very faint mercaptan-like odour. It is not soluble in water. It may cause mild irritation to the eyes and skin. Chlorpyrifos is a synthetic organophosphate acetylcholinesterase inhibitor, a reproductive toxicant and a neurotoxicant used as a pesticide. It is a highly toxic colourless, white or light brown crystalline solid with a slight rotten egg odour that is absorbed by inhalation, ingestion or contact. The chemical structure of this compound:

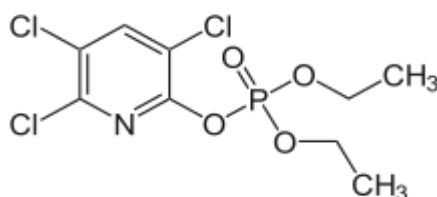


Fig. – 1: Structure of Chlorpyrifos

The indiscriminate use of unsafe insecticides poses a serious threat to the public health of the country. Some seriously hazardous pesticides like Shobicron, Nogos, DDT, Diazinon etc. have been used by traditional fishermen, peasants, businessmen and others in uncontrolled doses in the processing and storage of fish or agricultural produce to prevent infestation of blowflies, mites and beetles. The residual effects of such organic compounds in human organelles are known [18].

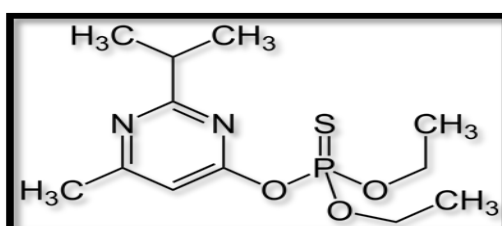


Fig. - 2: Structure of Diazinon

Various organochlorine insecticides are used by traditional fishermen in the preservation of dried fish. The concentrations of organochlorine insecticides such as DDT (dichlorodiphenyltrichloroethane -  $C_{14}H_9Cl_5$ ) and heptachlor were studied to estimate the current scenario of insecticides used in the preservation of dried fish at different times of the year [19].

In this way, people started thinking about how to reduce the infestation of insect larvae, flies, mites, beetles etc. Unfortunately, many people like farmers, fishermen, businessmen, livestock farmers and many other professionals mistakenly use pesticides, insecticides and harmful chemicals like DDT, formalin, petroleum etc. Therefore, they often use kerosene to reduce infestation by insects, worms, etc. Field experience has shown that these harmful substances are not safe for health. Khoti workers use these harmful substances on the fish without any training, without knowledge of the appropriate dose and without permission from the competent authority [20].

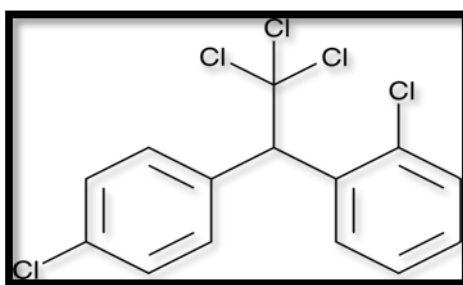


Fig. – 3: Structure of DDT

Of the various groups of pesticides, organophosphorus insecticides are increasingly used in South Asian countries. Organochlorine insecticides are synthetic organic insecticides containing carbon, chlorine and hydrogen. Due to their low water solubility and high lipophilicity, they are extremely harmful to living organisms and the environment [21, 22]. Due to their longevity and modest value, the OC insecticides such as dichlorodiphenyltrichloroethane (DDT), aldrin and endosulfan have been widely used for pest control [21].

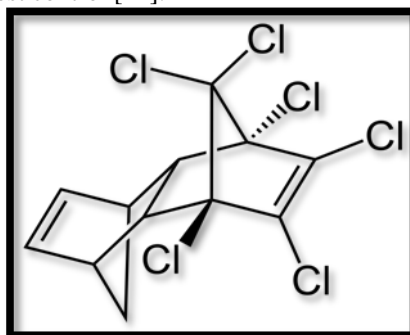


Fig. – 4: Structure of Aldrin

Pesticide use has declined sharply on sunny days [23]. Studied the traditional drying methods for commercially viable marine fishes in the coastal region of Bangladesh and found that fishermen soak the raw fish in various types of insecticides, including DDT, Nogos (dichloroves) at concentrations of 20-80 ppm (parts per million) [7,16] before drying.

It has been reported [24-27] that DDT is used in the preparation of dried fish. The use of DDT or other chlorinated insecticides in the preparation of dried fish is a serious matter as far as human health is concerned. The acceptable daily intake level of DDT for humans is 0.01 mg/kg body weight (European Food Safety Authority (2008)), and regular consumption of dried fish of this type can lead to the accumulation of these toxic chemicals in the human body. The presence of DDT has been detected in dried fish samples from Bangladesh, and such dried fish coming to India from Bangladesh may contain such chlorinated insecticides. During the interview, informants reported that they do not use chemical substances as preservatives and now treat the fish with formalin. This is often due to a lack of awareness or education. The use of toxic chemicals in food is worrying and the competent authorities should take the necessary measures to prevent such activities.

In most of the khoties of Purba Medinipur district, especially in Junput, Jaldha, New Jaldha and Dadanpatrabar Matsha Khoties different types of insecticides, pesticides or harmful chemicals are frequently used for dry fishing [16]. Therefore, they generally face many diseases. During the fieldwork, most khoti workers shared their experiences and commented on the problems they faced. Ms. Barman, a housewife, 46 years old, shared her experience, "We regularly work in dry fishing in this Junput Khoti. We have a family business based in Khoti. My four family members are employed there along with two or three workers. Twenty to twenty-five years ago, we did not use any chemicals to prepare dry fish. Sometimes we used only gammaxene powder or pholidol churno to preserve the precious dried fish in the long run. These substances helped to protect the dried fish from infestation by worms, insects and pests. However, as

the demand and selling price of the different types of dried fish gradually increased, we started using different chemicals, mainly to preserve the colour and quality of the dried fish. We use these chemicals mainly during the rainy season or in cloudy environments. In such environments, we use chemicals to dry the fish early and maintain its quality and colour. This way we can avoid losses and book some profit."

In recent times, traditional fishermen in these khoties dry the fish with various pesticides like Cypermethrin (Metacid, Hamla, Tata Tafgor), Endosulpher, Ustaad (Cypermethrin 10% EC) (<https://dir.indiamart.com/items/upl-ustaad-insecticide-s173986.html>), Dash, Forent 10, EPC powder along with Action 50 and Folidol Churna etc. [28]

In each khoti, the drying area is covered with thick layers of straw and nets on which the fish are spread. Both sun drying and salting (curing) are done in the same area. The fish are turned over at regular intervals to speed up the drying process. Some pesticides and preservatives such as Dash, Ostad, Forent-10, EPC powder, Dursban and Doom are used to prevent infestation of the fish [29]. Under normal conditions, they usually used 10 to 15 drops of pesticides in 80 to 100 litres of water when washing fresh fish. Since the khoti workers and others do not know the effect of insecticides, the residual effect of harmful chemicals and pesticides or insecticides is limited [30].

### Toxicity of harmful chemicals and pesticides/insecticides:

#### Cypermethrin:

This substance is considered to be very highly toxic. It is a synthetic pyrethroid used mainly in agriculture to control various types of insects and pests. However, nowadays this harmful chemical is also used by khoti workers to preserve dried fish, especially to control insects and pests.

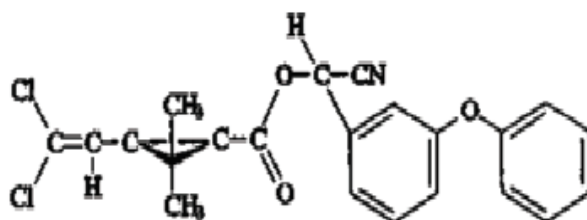


Fig. – 5: Structure of Cypermethrin

#### Recommended use for humans:

Cypermethrin is used on a wide range of crops. In general, maximum residue levels are low, ranging from 0.05 to 2.0 mg/kg in the various foodstuffs. Residues are further reduced during food processing. In food of animal origin, residues can range from 0.01 to 0.2 mg/kg of the product. Residues in non-food products are generally higher and can be up to 20 mg/kg of product. Values for total dietary intake are not available for men, but it can be assumed that oral exposure in the general population is low to negligible (WHO, 1989). During field observation, it was found that a large number of people (khoti workers) are illiterate or have only a low level of education. Therefore, they know little about the application, dosage and harmful effects of this insecticide or pesticides. They hardly follow safety guidelines to avoid mixing this insecticide with the dried fish they produce, especially when they use it for pest control.

#### Toxic effect:

Toxicity to humans results from accidental or intentional exposure by inhalation, skin contact or ingestion. Acute oral intoxication with cypermethrin in humans is usually manifested by neurotoxic and gastrointestinal effects. Cardio-toxic effects following ingestion of this compound have occurred in a few cases but have been under-reported [31].

#### Methyl parathion:

Metacid 50 is one of the main variants of methyl parathion, a very popular insecticide used in agriculture. Nowadays, fishermen use metacide for various purposes, especially in dry fishing.

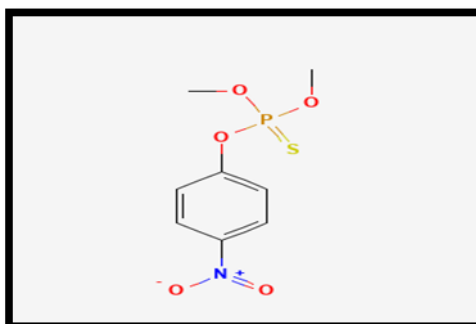


Fig. – 6: Structure of Methyl parathion

**Toxic effect:**

Metacid is a severe poison and very harmful to human health. It generally causes fatal organophosphate poisoning very quickly with headache, dizziness, blurred vision and chest tightness, profuse sweating, nausea and vomiting, frequent diarrhoea, muscle twitching, convulsions, coma and finally death [32].

**Endosulfan:**

This is the name for a chlorinated hydrocarbon. It is mainly used as an insecticide, especially from the cyclodiene subgroup. It is naturally a contact poison for various insects and mites when traditional fishermen store their dried fish and various fish species in their khoti premises [33].

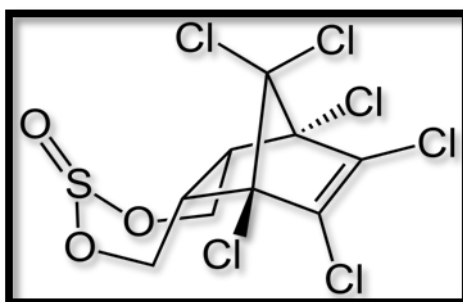


Fig. – 7: Structure of Endosulfan

**Toxic effect:**

However, few data are available on the acute fish toxicity of endosulfan sulphate [34]. In their study, found that the acute toxicity of endosulfan sulphate to three species of fish native to inland Florida (mosquitofish [*Gambusia affinis*]; least killifish [*Heterandria formosa*]; and sailfin mollies [*Poecilia latipinna*]) and fathead minnows (*Pimephales promelas*). Ninety-six-hour acute toxicity tests were conducted with each fish species under flow conditions. It belongs to the cyclodiene organochlorine group [35]. Endosulfan, an organochlorine insecticide (OC), is a widely used agricultural pesticide despite its high toxicity. The toxic effects of endosulfan can affect the human body over a broad spectrum [36]. The low use of endosulfan in the preparation and preservation of dried fish therefore affects human health.

**Chemical composition:**

Gammaxene:

The chemical name of Gammaxene is gamma-hexachlorocyclohexane and is commonly used as an insecticide. This compound contains 7 chlorine atoms. Its chemical composition is C<sub>6</sub>H<sub>6</sub>Cl<sub>6</sub>.

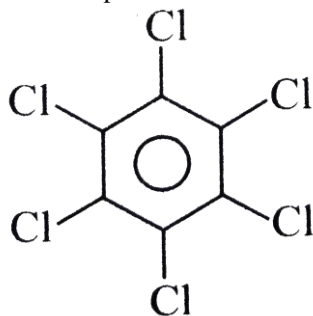


Fig. – 8: Structure of Gammaxene

**Effects:**

Gammaxene is an insecticide used by most people in households, shops, warehouses [37] and on pets to get rid of insects such as ants and cockroaches. Gammaxene is often inhaled by users when they handle it, especially when traditional fishermen use it to protect their dried fish from various insects. Mistakenly, people are confronted with toxic complications [38, 39].

From the data collected based on interviews and case studies, it appears that khoti workers have little knowledge about its side effects or complications due to the constant use of Gammaxene. They do feel that it has some adverse effects, but they cannot physically comprehend them. It is now scientifically proven that gammaxene causes some complications in the human body when exposed regularly. These complications include vomiting, agitation, muscle spasms, ataxia, and tonic and clonic spasms [38].

**General impact assessment:**

There are serious effects of pesticides and insecticides on the human body and mind that may ultimately lead to various health disorders ranging from mild skin irritation to birth defects, rashes, scabies, tumours, cardiac and respiratory problems, endocrine disorders, genetic problems, serological and nervous disorders, coma or death. Practical experience has shown that children are often more sensitive to the chemicals, pesticides or insecticides used than adults or older people. Pesticides can affect the reproductive system and the early stages of foetal development [39, 40]. In their study [40], they examined the particular effects of some locally used organochlorine, organophosphorus and some other pesticide or insecticide residues on marketable fish, aquatic animals and meat from Nadia district in West Bengal [41]

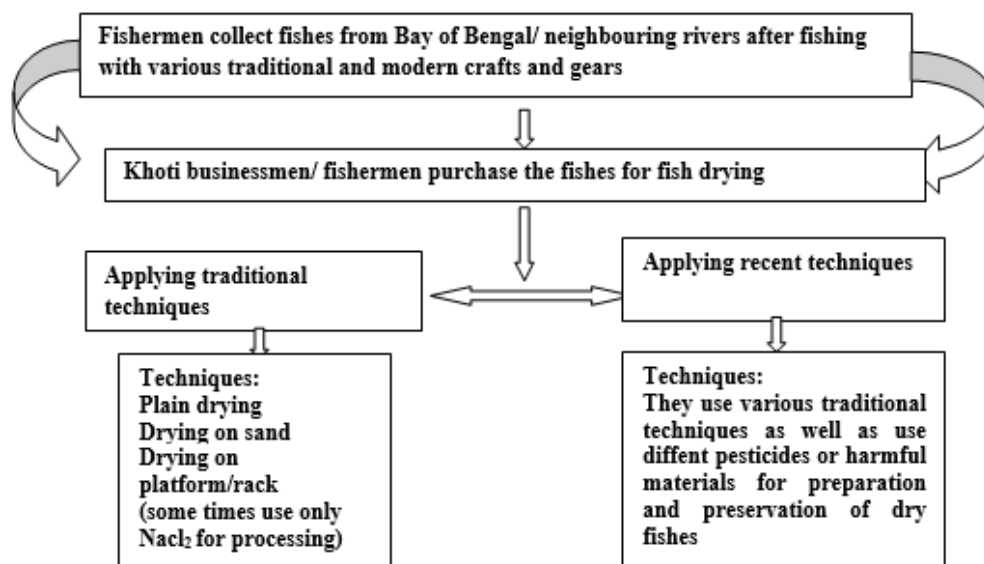


Fig. - 9: Schematic diagram of fish drying techniques in different modes

**Direct and indirect effects of harmful substances used:**

These pesticides are usually used on agricultural land and are considered very toxic. Although they have a huge toxic effect, traditional fishermen still use these pesticides in an unscientific way in the preparation of dried fish because they are not properly trained and sensitised. The negative impact is also seen in the export of dried fish. In the 2010/11 financial year, 200 tonnes of dried fish were banned for export abroad [42]. For this reason, traditional fishermen in the study areas who engage in the preparation of dried fish were also affected economically to some extent. The demand gradually decreased. The market price also decreased.

The businessmen and the fishermen of Junput, Dadanpatrabar Matsha Khoti and some other khoties use such chemicals and harmful pesticides which cause problems to their hands and legs. Sometimes they also suffer from vomiting, insomnia, loss of appetite, skin rash etc. [17, 43]. A local doctor who often treats the khoti people said:

"The traditional fishermen who put the raw fish in chemically mixed water and lift it out of the chemical water after a few hours to dry it without wearing gloves generally have adverse effects on the hands and legs of these workers. If the hands and legs are charred or have skin diseases when they come in contact with the chemical water, they may develop cancer. We have to treat such patients regularly. The women who work in these areas suffer from various diseases. Especially nursing mothers and their children become victims"



Fig. 10: Raw fishes sunk into chemicals or insecticides mixed water



Fig. 11: Raw fishes sunk into chemicals or insecticides mixed tank



**Fig. 12:** Washing the fishes



**Fig. 13:** Fish drying



**Fig. 14:** Fish drying processing

An elderly traditional fisherman, Mr Das, 64 years old, from Junput Matsha Khoti, commented "We use different chemicals and other substances to dry the fish. For more than nine years, we have been using different chemicals that we buy from Contai Super Market. When the chemicals are used in the preparation of the dried fish, the dried fish gets a shiny colour and stays in good condition for a long time, and worm infestation is prevented. Moreover, the fish can be easily dried during the rainy season. The chemicals used to make dried fish are generally sold at very high prices.



Therefore, most of the traditional fishermen of this khoti use these chemicals in processing dried fish. All the packets or jars are labelled in English or other languages, but I can only read Bengali very slowly. Therefore, I always identify the packets by the front and back view and the colour of the packets or jars. I cannot follow the instructions for use. In this case, the vendors where I buy the chemicals educated me about the use and dosage of the substances."

During data collection, nearly 110 people were interviewed. Of these, 29 (26.36%) of the khoti workers reported that they suffered from severe complications such as severe skin problems, allergies, severe vomiting, headaches, insomnia, etc. when they used pesticides or harmful chemicals regularly for a long period. On the other hand, 43 (39.09%) khoti women workers shared their experience that they generally suffered from mild complications such as skin infections, headache, loss of appetite, mild vomiting, etc. During the study, 38 (34.54%) khoti women workers reported that they had few or no complications due to exposure to various pesticides or harmful chemicals during the preparation of the dried fish. From the case studies, it appears that women and the elderly are more affected than their male counterparts. Nursing mothers have more problems due to regular contact with these substances. In most cases, the children who receive milk also suffer from digestive disorders, skin problems, loss of appetite, irritation and other problems.

### Summary and Conclusion:

It is a common problem in the coastal areas of Purba Medinipur, especially among the khoti people. They are gradually suffering from various types of common health problems. However, due to a lack of knowledge, they usually do not find out the real causes of these health problems. They hardly go to doctors, but mostly rely on their indigenous herbal-based treatment systems. This is the common phenomenon that they encounter doctors at an extremely serious level. For reasons of profit, sales and better preservation, many khoti owners have started using these harmful substances regularly.

### ACKNOWLEDGEMENT:

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