HASIL PENILAIAN SEJAWAT SEBIDANG ATAU *PEER REVIEW*
KARYA ILMIAH: JURNAL ILMIAH *)

Judul Jurnal Ilmiah (Artikel)	: *The characteristics of waste product from the process of pemindangan in local village Bali*
Jumlah penulis	: 1 Orang
Status pengusul	: Penulis Mandiri
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c. Volume, No, bulan, tahun	: Volume 434, 3rd Annual Applied Science and Engineering Conference (AASEC 2018) 18 April 2018, Bandung, Indonesia
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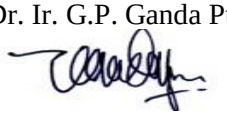
Tanda tangan : 

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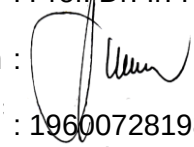

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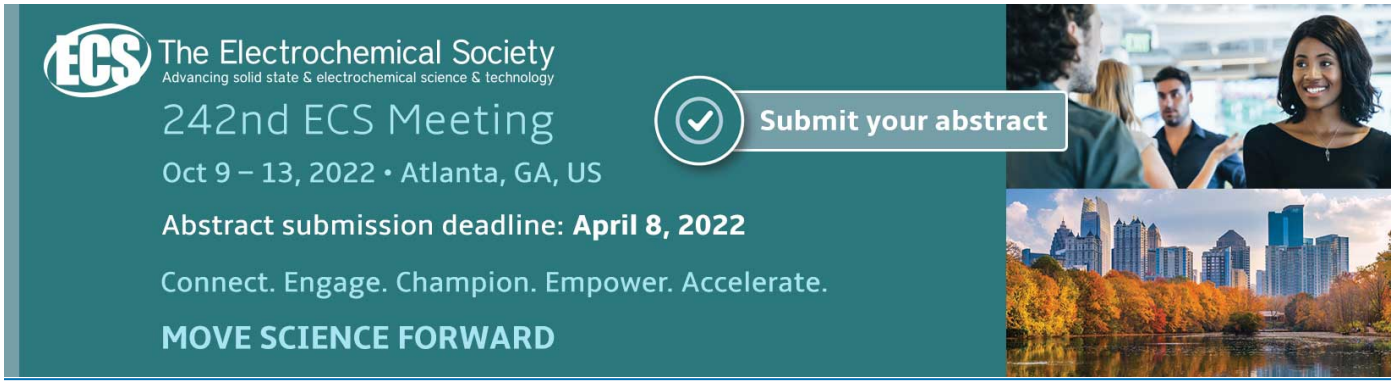

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The characteristics of waste product from the process of *pemindangan* in local village Bali

I G S Pandit*

Faculty of Agriculture Universitas Warmadewa Denpasar Bali, Indonesia

*suranaya_pandit@yahoo.com

Abstract. In regards to the process of "*Pemindangan*", there will be so many waste products, both solid and liquid which contain hazardous organic compounds which are potentially capable of inflicting negative effects to the environment. Kusamba is a village which is considered the central of "*Pemindangan*" in Bali. This study observed and evaluated waste treatments done by fisherman in Kusamba Village. This study found waste management from the production of "*Pindang*" in Kusamba has been conducted through the specialized drain systems which physically filter the solid waste using the iron wires attached to them. The process was then continued by preceding the filtered water to the containers having been added with chlorine to perform chemical filtration. The last procedure is to apply biological aeration on the filtrated water. Chemical analysis showed the wastewater was already able to meet the criteria for environmentally friendly materials based on the standard water quality.

1. Introduction

The fishery industry is important economically in a number of countries worldwide. The increasing trend of global fish production in the past decade due to the increasing consumption of fish products is expected to continue [1]. Many species of the family *Scombridae* (tunas, mackerels and seerfishes) are among the world's most economically important species. Reported global landings of tuna and tuna-like species was 7.66 million tons in 2014 [2]. *"Pindang"* is one of processed fish-themed foods consumed by a wide variety of people, requiring mackerel tunas which fall under the biological *family scromboidae* as one of the main ingredients [3].

The fishery production advances in each year, in which according to the data taken from Bali Fishery and Marine Department, the production has been reported to have increased by 9.191.90 tons or 15.97% larger than it was in the previous year. Most of the harvested mackerel tunas which are 7.365.10 tons in total are processed through a certain course called "*Pemindangan*" from which the actual product which is "*Pindang*" is produced as well as sold to a wide variety of people for consumption. The "*Pemindangan*" process involves several practical procedures, in which the first step is to clean the selected mackerel tunas. Having been cleaned, the fish are placed in a certain container or bamboo basket which holds 8-10 mackerel tunas, and then followed by putting them in boiling water having been added with some salt at 100^0C for 30 minutes. Not only is the "*Pindang*" produced through this process, but also some waste as its residual material [4].

Waste is a residual material produced along with the main production which is generated by both industries and households and gradually become worthless at a certain point for not having economical value. Waste as a residual material is generally divided into two groups, namely solid waste and liquid

waste. In regards to the process of "*Pemindangan*" having been mentioned above, the solid wastes generated from the process are generally shrimp heads or fish, shells, scales, fish bones, etc.; while the liquid wastes are mainly in the form of blood, soiled water, excess of boiling water, melted ice blocks from the production chamber, and many others. These liquid wastes in particular, contain hazardous organic compounds which are potentially capable of inflicting negative effects to the environment [5]. In addition, the excess boiling water from the process of "*Pemindangan*" has greater potentials of contributing pollution to the environment as it possesses stench resulting from decomposing protein and grease [6].

Kusamba is a local village which is considered the central of "*Pemindangan*" in Bali. In accordance with the assessment conducted by the Ministry of Maritime and Fisheries Affairs Number: Kep.01/MEN/2007, Kusamba was appointed as a location for central development of fishery management in 2007 [7]. As the central location for the process of "*Pemindangan*" capable of producing 20 tons of "*Pindang*" production per day, it is considered significant by the researcher to identify and evaluate the existing procedural waste management from the production at the central "*Pemindangan*" Kusamba. The results of this result are expected to be able to contribute several benefits not only to the fishermen in Kusamba, but also to the local government as well as the people the village in particular.

2. Research methods

The research methodology is divided into several steps, such as survey, observation and data collecting, evaluation, and reporting. Survey on the location was done in order to gain permission for research and determine the location points for the observation on the exact places where waste management is organized. Observation was conducted on the existing waste treatment done by local fisherman. For evaluating the waste quality, 1.000 ml of the waste having been produced and disposed of to the environment was collected in order to be analyzed at the laboratory. The collected data were then analyzed based on the standard reference, regarding the quality of water disposal by State Minister for The Environment No 5 Year 2014. The observational result of the existing waste management will be described descriptively. Numerical data will be tabulated and analyzed in order to determine the conclusions.

3. Result

Kusamba is a village located In Dawan District, Klungkung Regency, which can be reached approximately 30 kilometers from capital city of Bali. Kusamba is a village known to be the largest central "*Pemindangan*" in Bali, housing 70 blocks of "*Pemindangan*" slot which are open from 11 am until 5 pm depending on the number of fish production and availability at the cold storage. The mackerel tunas required for the "*Pindang*" are harvested by utilizing *purse seine* and trolling line. The process of *Pemindangan* is practically conducted by using homey tools. It is performed through several utilizations of bamboo basket on which some salt is sprinkled prior to being used to hold the fish, which is followed by putting the bamboo basket containing the fish into stainless steel containers containing boiling water and adding some ballasts to keep the fist underwater. The process is concluded to be finished as the fish eyes implode.

3.1 Type of waste management in kusamba

Kusamba is the central "*Pemindangan*" which traditionally utilizes folksy tools to produce processed fish. The technique applied in order to manage the material disposal as waste from the process of "*Pemindangan*" in Kusamba was performed physically, chemically, and biologically (Fig 2).

Figure 1. *Pemindangan* and its waste product: cleansing fish and salination (A), "*Pindang"* products in Kusamba (B), blood from fish processing (C), and wastewater from *Pemindangan* process (D).

The waste management is physically conducted by using filters made of iron wire. The iron-wired filters are installed between the drains based on their situation by which the solid wastes are filtered to be disposed of or placed in the ground. The filters are in the form of iron bars or strainers which are routinely supervised in order to dispose of the solid disposals. Chemically, waste management is performed by using chemical compound in the form of chlorine (cl_2). This process is done by using containers to which the liquid waste passed from the physical drains and left to sediment. During this phase, the solid particles from the waste will settle on the bottom of the containers while the unsoiled waste proceeds to the surface. In addition, some chlorine is also added as necessary. The liquid waste which is already on the surface after undergoing sedimentation proceeds to the next containers. On the other hand, the solid particles left on the bottom of the containers are routinely cleaned to prevent environmental pollution. Biologically, waste management is performed in the next containers by using aerator by which the aeration process can be completed in order for the microbes to be able to grow and develop.

There are many efforts related to the waste management executed in Kusamba, starting from physical management through the installation of iron-wired filters on each drain which allows solid disposals to become separable. Following the physical method, the waste management is continued chemically by utilizing sedimentation and chlorine. Having been processed chemically, the waste advances to the last containers in which the biological method takes place through aeration, allowing the waste to revert back to being regular water for irrigation or just nontoxic disposal.

3.2 Characteristics of waste product in Kusamba

Having been aerated as the last procedure, approximately 1000 ml of the wastewater was taken for being tested at the laboratory. The observation on the wastewater quality was conducted qualitatively and quantitatively to assess the quality of waste management in Kusamba which turned out that the result is good. The wastewater which is environmentally ready to be disposed of to the waters in Kusamba is colorless, similar to regular water in general, slightly smelly, but no sedimentation.

Table 1. Chemical analysis of waste product in Kusamba.

Variable	Unit	Result	Standard[8]
BOD	Ppm	53.80	75
COD	Ppm	148	150
PH		6-7	6-9
TSS	Ppm	58.80	100
Chloride	Ppm	0.88	1
Grease-oil	Ppm	9.8	15
Ammonia	Ppm	3.88	5

The quality of waste in Kusamba was quantitatively assessed through chemical analysis at the laboratory. The assessment result (table 1) was then compared with the standard quality of wastewater in accordance with the Fishery Department and State Minister for The Environment No 5 Year 2014 [8]. Based on the wastewater analysis on the table above which was compared with the quality standard, the wastewater generated from the process of "*Pemindangan*" in Kusamba has already met the criteria and requirements as stated on the Regulation of the State Minister for Environment No 5 Year 2014.

4. Discussion

The management of wastewater aims to remove the contaminant parameters existing in the wastewater itself until the permission to dispose of the waste to environment is granted as stated on the regulation of standard quality or until when the waste is ready for recycle. The wastewater management involves physical, chemical, and biological methods [9-11]. The waste generated from the production can be in the form of solid, liquid and gas materials. The solid wastes are mostly in the form of pieces of fish, scales, gills, or innards. The liquid wastes are mostly in the form of blood, mucus, dishwater and water excess from the boiling water. The liquid waste generated from the production process contains organic compounds which are about 20 kg (Biological Oxygen Demand) BOD/ton in weight, while the gas waste is generated by the appearance of ammonia, hydrogen sulfide or *ketone*. All these wastes are then directed to drain systems proceeding to the containers [11].

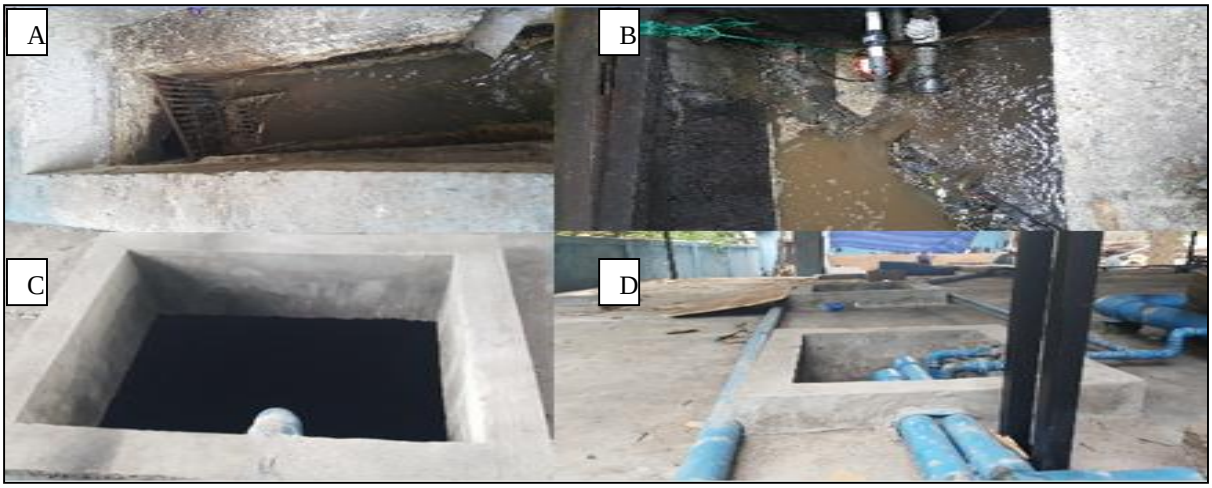

Figure 2. Waste management efforts in Kusamba: physically (A, B), chemically (C), and biologic aeration (D).

Physical method is applied on the waste management in order to separate the solid, liquid and gas wastes. This method is able to separate the solid waste from the others. Having been separated, the individual solid waste is further managed, allowing it to become environmentally friendly materials, whereas the liquid and gas wastes are managed through chemical and biological methods respectively. The liquid wastes from the production process are generally in the form pieces of meat, fish, scales, gills, or innards [5], [9]. The physical method for the solid waste from the production is actualized by installing filters or iron wires.

Chemical management as the continuation of physical procedure is executed in order to neutralize both acid or base contained in the waste, reform the mud separation process, segregate the insoluble solids, reduce the concentration of oil and grease, intensify the efficiency of installation, flotation and filtration, as well as oxidize colors and toxics [12]. The chemical management procedure applied to counter the waste in Kusamba is conducted by adding chlorine, which is effective as both disinfectant and oxidizing agent. Chlorine is one of the oldest disinfection agents used, which is one of the safest and most reliable. It has extremely good properties, which conform to the aspects of the ideal

disinfectant. Effective chlorine disinfection depends upon its chemical form in wastewater. The influencing factors are pH, temperature, and organic content in the wastewater. When chlorine gas is dissolved in wastewater, it rapidly hydrolyzes to hydrochloric acid and hypochlorous acid [11,13].

The biological management procedure aims to reduce dissolved components which are organic compounds in particular. This method is applied up to the point where the waste itself is environmentally safe to release, which is tested on microbes or plants beforehand [11]. The waste from the production process in Kusamba is biologically managed through aeration procedure prior to being released to the environment. Aeration has been used to remove trace organic volatile compounds (VOCs) in water. It has also been employed to transfer a substance, such as oxygen, from air or a gas phase into water in a process called "gas adsorption" or "oxidation", in order to oxidize iron and/or manganese. Aeration also provides the escape of dissolved gases, such as CO2 and H2S. Air stripping has been also utilized effectively to remove NH3 from wastewater and to remove volatile tastes and other such substances in water [14]. Previous researches mentioned that aerobic treatment is effective in reducing harmful gaseous emissions as greenhouse gases (CH4 and N2O) and ammonia [11]. Color alteration, scent, or sedimentation can be considered an indicator showing if there is any decaying waste. The scent appearing from the liquid waste of fishery activities is caused by the decomposing organic materials from which volatile amine, diamine, and ammonia are produced. While on the other hand, solid waste having been through the filtration sediments on bottom waters [15].

The quality of wastewater in Kusamba is quantitatively good and already meets the criteria stated in the Indonesia standard. The acidity of the waste in Kusamba is around 6-7 which is classified as being neutral. The acidity of low quality wastewater is usually acid (pH<7) or base (pH>8). However, in the case where processed fish industries are involved, the wastewater generated usually stays at 7 which is neutral due to the decomposition containing protein and the other ammoniac compounds. The contents of liquid waste from the fishery industries highly depend on the contamination severity level as well the water quality used in the production process [11], [15]. "*Pemindangan"* process uses salt for preservation of food products; hence the content of chloride increased in discharged water. The presence of chloride in the waste product is categorized as a pollutant for many reasons. Chloride is necessary for water habitats to thrive, yet high levels of chloride can have negative effects on an ecosystem. Chloride may impact freshwater organisms and plants by altering reproduction rates, increasing species mortality, and changing the characteristics of the entire local ecosystem [16].

The boiled water excess from the process of "*Pemindangan*" which immediately becomes a waste is likely to contain many organic compounds. Organic material requires oxygen and microorganisms in order to decompose. The appearances of such organic compounds were investigated through BOD parameter. In addition, liquid waste of fishery industries which are mainly from blood after weeding the innards and cooking process, contains a large amount of nutrient, oil, and grease which results in the high Chemical Oxygen Demand (COD) value. Deficiently filtrated liquid waste often contains highly suspended substances (TSS). Fats, oil and grease (FOG) are among the most objectionable components from the fish processing wastewater. The presence of FOG in an effluent is mainly due to processing operations such as canning. Fish oil, unless removed in a fishmeal plant, often ends up in the processing wastewater. The FOG should be removed from wastewater for numerous reasons: it usually floats on top of water's surface and affects the oxygen transfer to the water; it is objectionable from an aesthetic point of view, and its decomposition generates unpleasant odors. Suspended solids (TSS) present similar problems. Heavy solids also sediment and over time can clog pumps, pipes, tanks or accumulate at waterways floors. Solids and FOGs should be removed as soon as possible in the wastewater treatment process [5].

The waste management in Kusamba which is initiated from filtration and chlorine addition to aeration is capable of reducing the BOD, COD, TSS, and other standard parameters for waste product[9]. The waste generated from the process of "*Pemindangan*" in Kusamba also does not contain any high concentration of fat, oil, and grease, which automatically proves that Kusamba is a village with a good record of waste management.

5. Conclusion

Based on the observations and analyses having been conducted on the quality of wastewater at Central Processing "*Pindang*" in Kusamba Village, Bali, we concluded that the waste management from the production of "*Pindang*" has been conducted through the specialized drain systems which physically filter the solid waste using the iron wires attached to them. The process is then continued by preceding the filtered water to the containers having been added with chlorine to perform chemical filtration. The last procedure is to apply biological aeration on the filtrated water. The result of the analyses in regards to the wastewater which is disposed of the environment shows that the wastewater is already able to meet the criteria for environmentally friendly materials based on the standard water quality.

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