

Study on proposing measures to reduce water use in dried fish processing in Binh Thang traditional craft village, Binh Dai district, Ben Tre province - Viet Nam

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ABSTRACT: Water resource is one of the most valuable natural resources which have been given to humankind by the nature, water accounts for more than 70% of human body weight, human and creatures could not exist without water. However, at present time, the resource has been wasted in many places and in many fields of production and services, especially in craft villages in Viet Nam. In order to understand actuality of using water in traditional craft villages in Ben Tre province – Vietnam and propose methods to reduce water consumption, there is necessary to implement a research related to the problem, and for this reason the research “Study on proposed measures to reduce water use in dried fish processing in Binh Thang traditional craft village, Binh Dai district, Ben Tre province - Viet Nam” has been performed. Results gained from the research showed that: in dried fish processing of Binh Thang traditional craft village, water consumption level of the production households is different; levels of water consumption in the households are depended on production process as well as attitude, including awareness of the producers; and the state management as well as production management play important role in water consumption in the village. Based on the research results, there are some solutions regarding changes of steps in processing, manipulation, water cycle and reuse,... as well as promoting awareness about water efficient use among the producers have been initiated

Keywords: Traditional craft village, reduction, water resource use, dried fish processing, Binh Thang – Vietnam

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I. INTRODUCTION

Dried fish processing village is one of communities of Binh Thang commune, Binh Dai district, Ben Tre province - Vietnam. Life of the village depends mainly on exploiting, processing dried fish and aquaculture. Among the production fields of the village, the dried fish processing of Binh Thang traditional craft village has created a considerable volume of goods, timely meet the diverse needs of people's lives, contributing significantly to the development of the local economy, and increasing export turnover. Traditional dried fish processing of Binh Thang Commune has been operating for over 50 years. However, along with the strong development of seafood processing in terms of scale, capacity of operation, the problem of environmental pollution is also increasing and it becomes increasingly serious; household waste, production garbage and wastewater from the village have polluted the environment and blocked the flow of existing drainage ditches as well. Waste collection and treatment systems in the traditional craft villages, that have not been invested proportional to the current production scale, are often overloaded, stagnant water and wastewater have been interspersed in residential areas. On average daily production of the village discharge into the environment over 600m³ of wastewater without proper treatment and it causes polluting the traditional trade village itself. Although, the Binh Thang traditional craft village has long been established and recognized since 2007 but the problem of environmental treatment has not been paid pertinent attention, especially the problem of wastewater, most of the production households have no environmental treatment system. In addition, local people are not aware of environmental protection as well as saving resources in general, and water resource in part; and local authorities do not have measures to manage the village in accordance with sustainable development. Therefore, a systematic and scientific study on water use status in dried fish processing in Binh Thang traditional craft village, Binh Dai district, Ben Tre province - Viet Nam, since then proposing measures for saving water in production and reducing environmental impacts needed to be taken and this is the main reason for the research implementation.

II. LITERATURE REVIEW

2.1. The concept of craft village and traditional craft village

A craft village means one or more population clusters of hamlets, villages or similar residential areas in a commune, ward or township (hereinafter referred collectively to as the commune level) which have craft and non-farming activities that produce one or more different types of products.

A craft village, which meet craft village criteria and have at least one traditional profession recognised, would be recognised as traditional craft village.

2.2. Criteria for recognizing craft village and traditional craft village in Viet Nam

According to the Circular 116/2006/TT-BNN of the Ministry of Agriculture and Rural Development of Vietnam, criteria for recognition of craft village and traditional craft village are, as follow:

- Craft village would be recognised if it meet such criteria as: The profession has appeared in the locality for more than 50 years by the time of request for recognition; The profession creates products bearing national cultural identities; The profession is associated with the name of one or more artists or names of the craft village; At least 30% of the total households in rural areas participate in rural trades; Having stable production and business activities for at least 2 years up to the time of application for recognition; and Well obeying the policies and laws of the State.

- Traditional craft village is only recognised if it meets all criteria for craft village and have at least one traditional profession recognized.

III. RESEARCH CONTENTS AND METHODS

3.1. Research contents

The objective of the research is to evaluate the current status of water consumption in dried fish processing in the Binh Thang traditional craft village, thereby proposing measures to reduce water consumption in the processing steps, increase the efficiency of the process and reduce the environmental impact as well. In order to reach the targets, the research focuses on the following issues: assessment of current status of dried fish processing in Binh Thang traditional craft village; the status of water consumption in the processing and wastewater generated from dried fish processing as well as impacts of the wastewater on public health in the craft village; and propose measures to improve efficiency of water use in the dried fish processing in the studied area.

3.2. Materials and methods

In the research implementation, there have been used a number of equipment such as car, motorbikes, recorders, water cans, baskets, questionnaires and so on. The methods which have been applied in conducting the research are: documentation and data collection, the data collection has been implemented by surveys through face – to – face contact or filling in given questionnaire; collected data analysis and assessment. The samples have been chosen randomly and representatively. Process and contents of the research implementation are illustrated in the figure 3.1 below.

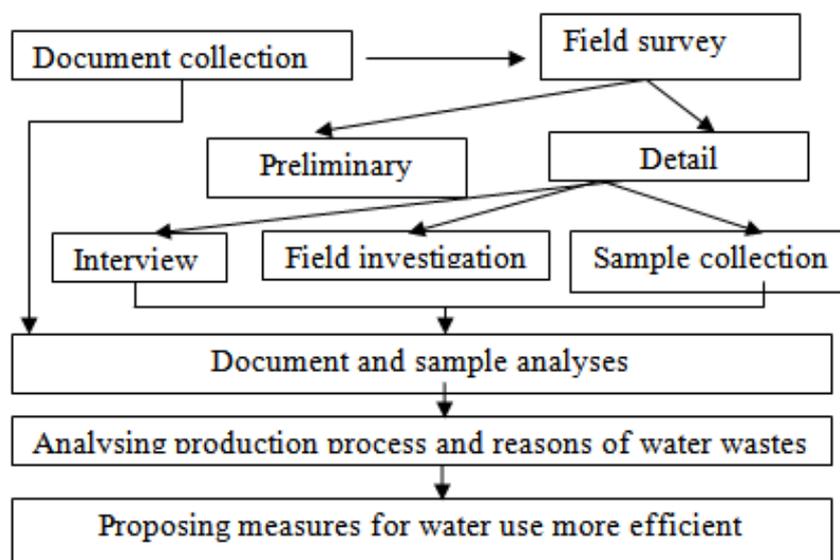


Figure 3.1: Process and contents of the research implementation

IV. RESULTS AND DISCUSSION

4.1. Current status of the production and wastewater in the Binh Thang Traditional Craft Village.

4.1.1. The production activity in the village

According to the data that have been gained from the research implementation, currently in the Binh Thang traditional craft villagethere are about 300 households operating dried fish processing with production size from 50 kg/household – per day to 600 kg/household – per day, total fish production of the village fluctuate between 15 ton and 90 ton a day. The production of the village happens year-round and there are two kinds of products: salty dried fish and salty dried one day of sunlight fish. Depending on the season of fishing, the products of the village could be dry stingray, dry snapper,dry mackerel and so on.

As the Binh Thang village is traditional craft of dried fish processing and small production sizeso production tools and equipment are put at home. The production process of all households in the village is quite similar, there only is a little difference in processing steps among a number of households in the village. In general, the process of production in the village is mainly through the following steps:

Raw materials (Fresh fish)→ Washing (1)→Pre-processing → Washing (2) → Spicy marinating →
→ Drying → Packing → Preserving

Fresh fish bought from fishing boats or vessels have been first washed (Washing 1), the washed fish is then eliminated head, scales, tail etc. In the next step, the preliminary fish has been washed again (Washing 2) and then it would be marinated with salt and spiciness. The salty – spicy marinated fish is dried by sunlight, if the marinated fish is dried a day in the sun, it would be called dried one day of sunlight fish. The last step of the production process in the village is packing - Preserving.

4.1.2. Wastewater in the Binh Thang Traditional Craft Village

Results of the preliminary survey on status of wastewater in the village show that total volume of wastewater generated and discharged into the environment about 750m³/day. The wastewater is generated mainly from activities such as washing raw materials, washing semi-finished products, washing floors, washing factories, tools ... Waste water of the village contains blood, viscous, shredded, fins, heads, bones, scales, ... and it is directly discharged into the river, canal drainage in the area of the hamlet.

According to Tran Thi Tho (2016), concentration of environmental pollution substances in wastewater samples collected from the Binh Thang Traditional Craft Village is in excess of Viet Nam National Technical Regulation on wastewater. Results of analysing 06 wastewater samples collected from 06 households of the village are presented in the table 4.1 below:

Table 4.1: Characteristics of wastewater in the Binh Thang Traditional Craft Village

Parameters	Samples analysed						Reg.11:2015/Monre – VN (Column B)
	Samp.1	Samp.2	Samp.3	Samp.4	Samp.5	Samp. 6	
pH	6.5	6.9	7.5	6.7	6.8	6.8	5,5 -9
TSS (mg/l)	374	372	458	376	346	408	100
∑ N(mg/l)	57.8	72.2	58.6	62.5	84.4	69.8	60
Amoni(mg/l)	37.7	32.2	36.8	35.6	50.2	39.7	20
∑ Oil (mg/l)	68.5	30.4	32.6	31.6	32.3	48.7	20
BOD ₅ (mg/l)	740	457	653	406	425	564	50
COD (mg/l)	1,070	857	1,041	988	723	940	150
Coliform (MPN/100 ml)	2,5x10 ⁵	5,7x10 ⁶	1,1x10 ⁶	4,3x10 ⁶	4,6x10 ⁵	2.4x10 ⁶	5.000

Source: Tran Thi Tho (2016)

Notes: - Samp. (1- 6) are wastewater samples collected from 6 households in the village.

- Reg. 11-MT: 2015/Monre – VN – National Technical Regulation on the effluent of aquatic Products Processing Industry.

- Column B: Stipulating maximum values of pollutant concentration in wastewater discharged from aquaculture into water sources which is not used for domestic water supply

From the data presented in the table 4.1 above, it can be seen that besides the pH – parameter, concentration of all other pollutants in the wastewater is higher compared with the Regulation 11-MT: 2015/Monre – VN, some of the parameters such as BOD and COD are many times higher the regulation (BOD₅ in sample 1 is 740 mg/l compared with 50 mg/l stipulated in the regulation; COD in sample 1 is 1,070 mg/l compared with 150 mg/l stipulated in the regulation. With so high concentration of pollutants the wastewater

has heavily affected the environment including community health in the region. Therefore, the wastewater must be treated to meet the regulation before discharging into receiving body. Nevertheless, according to data gaining from the research implementation, treatment of the wastewater to meet the existing regulation is also big problem not only for the households in the village but also for the environmental managers in the region as well.

4.2. Actuality of water consumption in production of the Binh Thang Traditional Craft Village

As the households producing dried fish products are located in a commune which has got quite large area, so the distribution range of the households is relatively wide. However, as the production process of the households is quite similar, so the research has chosen production households in probability, there have 20 households representative of dried fish processing in the village been chosen to study the actuality of water consumption, most the households chosen are in the hamlets 1, 2, 3, 4 of the commune Binh Thang – Binh Dai district – Ben Tre province. The results of the research show that water is used in the most of processing stages from washing raw material to washing tools and with quite large quantity. Water using for dried fish processing in the village is tap water, river water and well water. The water using for the processing in the village has been got from such sources as: Community Water System; Community Water System combined with Dug Well; and Community Water System combined with River Surface Water. Details of the results of the research implementation are presented in the Table 4.2, Figure 4.1 and Figure 4.2 below.

Table 4.2: Actuality of water consumption in Binh Thang Traditional Craft Village

No.	Household Name	Average Production Yield (kg/day)	Processing Water Consumption On Average		Sources of water supply
			liters/day	liters/kg	
1	Vo Thi Phuong	200	1,500	7.50	*
2	Nguyen Thi No	100	900	9.00	*
3	Huynh Thi Hong	150	1,200	8.00	**
4	Nguyen Thi Em	100	950	9.50	**
5	Tran Van Luong	100	920	9.20	**
6	Nguyen Thi Tui	150	1,350	9.00	*
7	Dinh Thi Thuy	300	2,100	7.00	*
8	Mai Y Lan	100	900	9.00	*
9	Tran Thi Thuy	200	1,450	7.30	*
10	Nguyen Thi Thuan	90	980	10.9	***
11	Nguyen Duoc Anh	90	988	10.97	***
12	Tran Ngoc Thanh	100	920	9.20	***
13	Huynh Thi Van	80	900	11.20	***
14	Vo Thi Viet Duc	150	1,100	7.30	*
15	Nguyen Thi Le	100	850	8.50	*
16	Ngo Van Hung	100	920	9.20	**
17	Truong T. My Trang	50	450	9.00	**
18	Truong Thi Soc	90	900	10.00	***
19	Do Thi Nhanh	90	920	9.20	**
20	Do Thi Tuyet Nga	80	760	9.50	**
Σ		2.420	20,953	-	-

Notes: * Community Water System; ** Community Water System and Dug Well; *** Community Water System and River.

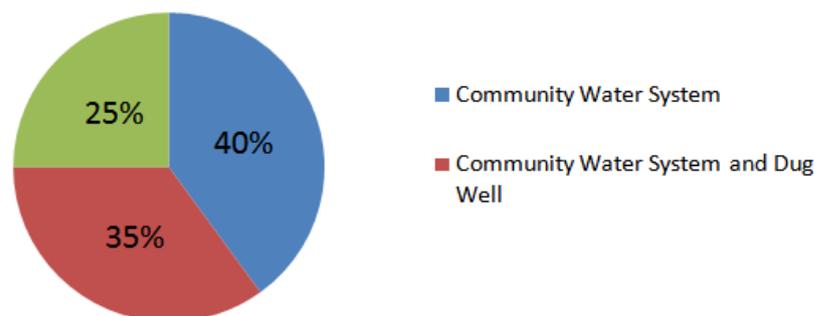


Figure 4.1: Sources of Water Supply in the Binh Thang Traditional Craft Village

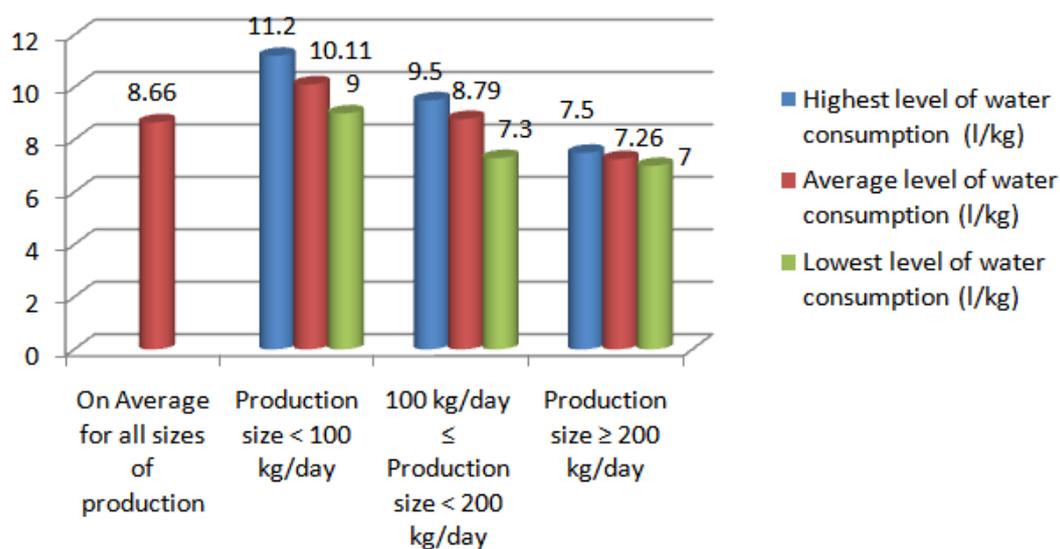


Figure 4.2: Level of water consumption for 01 kg fresh fish in the Binh Thang village

From the data presented in the table 4.2, figure 4.1 and figure 4.2 above, it can be seen that households of the village use water from different sources, there are three sources of water supply for dried fish processing in the village: community water system; community water system combined with dug well; and community water system combined with river surface water. However, amount of households using water supplying from the sources is not the same. Among them, amount of the households using water from community water system is dominated with 40% and only 25% of the households in the village use water getting from community water system combined with river surface water.

Regarding the level of water consumption for dried fish processing in the village, from the figure 4.2 presented above, it can be recognised that there is a difference in water consumption for 01 kg fresh fish in the processing. The difference in water consumption for processing in the village depends on size of production towards the more production size the less water used for 01 kg fresh fish in production. On average, for all size of production in the village, about 8,66 liters of water would be used for 01 kg fresh fish in processing, however, it would only be about 7,26 liters using for 01 kg fresh fish if the production size is equal or more 200 kg/day. There is also a different level of water consumption for 01 kg fresh fish in the processing of the households in the village, especially among the households of less 200 kg/day production size, the difference is quite big with the amount about 2,2 liters between highest and lowest levels of water consumption for 01 kg fresh fish in the processing, and this value is only about 0,5 liters among the households producing more or equal 200 kg/day fresh fish.

4.3. Analysing and assessing the reasons for waste of water in dried fish processing in the village

4.3.1. Results of research implementation

In order to analyse and assess the reasons for waste of water in dried fish production in the village, there are such actions as: measuring levels of water in each step of production process; observing manipulation of workers; and surveying people, including people who are not of dried fish processing field, have been performed. All data and information gained from the research implementation have been noted and then it is analysed and assessed. The data presented in the table 4.2 above are the results gained from measurement, assessment and summarisation of level of water consumption of the households in dried fish processing of the village. Observing activities as well as manipulation of the workers has discovered that: there are several stages (mainly washing) in dried fish processing and it has difference in some steps of production process among the households; manipulation of the workers is not the same in the households, even in one household, the manipulation of the workers between production shifts is little different; and production bottom layout is not the same in all households of the village. In order to get information in relation to awareness on water consumption and willingness of the households to water saving in production, the research has surveyed the households by direct interviewing and delivering questionnaire. The results gained from the research are, as follow:

- There about 85% of the interviewees are not aware of water resource and its precious and rare; 10% of the people recognised the resource is precious; and 5% did not give idea.

- Regarding the water consumption in production process, about 75% of interviewees answered that they use water in steps of the production process just due to habit, only 15% of interviewees have considered the use and the need in the processing steps, and the rest did not give information.
- For the questions relating to willingness to save water in the production there are up 65 % of the people who have participated in the survey do not have idea; 25% of the interviewees have willingness to that but do not know how to do; only 10% of the interviewees revealed that they have willingness to save water in dried fish processing and have applied solutions such as housekeeping, regularly control volume of water used..., and reuse if it is possible. The results of the research implementation are illustrated in figure 4.3 below.

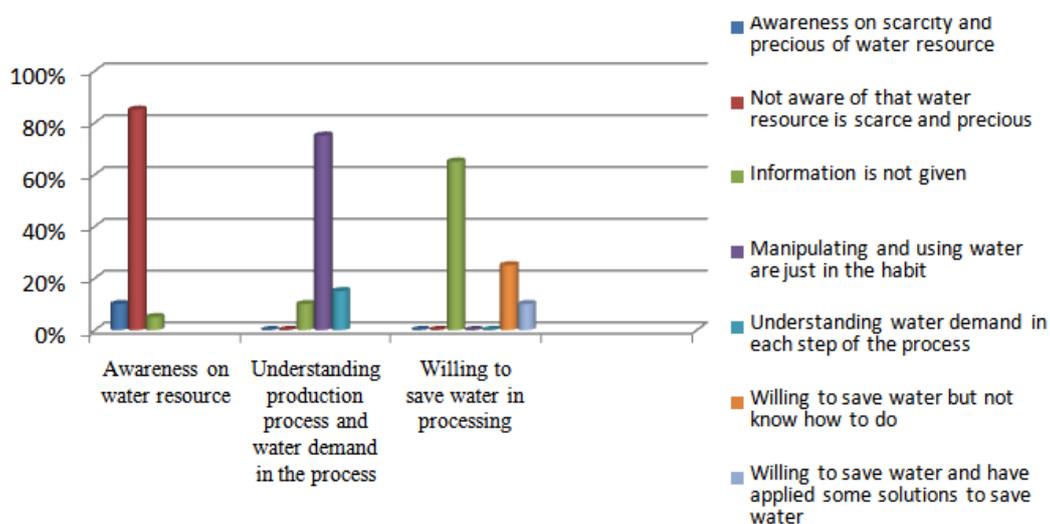


Figure 4.3: Results of surveying households in the village

4.3.2. Assessment of the reasons for waste of water and forecast of potential for saving water in dried fish processing in the village

4.3.2.1. The reasons for waste of water in the processing in the village

From the the results of research implementation, it can be seen that reasons for waste of water in dried fish processing of the Binh Thang traditional craft village are various and the reasons are generated from aspects of: equipment being used; production process of the households; manipulation of workers; awareness of the water users; and role and responsibility of environmental manager in the studied area.

The first reason for waste of water in dried fish processing in the village is that production relations are family – typical, clandestine; workers are family laborers; processing is "esoteric" models, keeps secrets for the family and complies with the "convention" without the improvement of scientific and technical progress; applying new technical solutions is not encouraged in the households.

Secondly, manufacturing technology and equipment are mostly backward and patchwork. Skill and knowledge of the workers are inadequate; Most of the production process in the village is manual labor, so efficiency of production, in general and water consumption in part, is much dependent to manipulation of the workers.

The third reason leading to waste of water in dried fish processing of the village is insufficient awareness of people on water resource and efficient use of water as well. In relation to the low awareness of people on water resource and water efficient use, there also are role and responsibility of environmental managers. Due to lack of human and material resources of the environmental management system in region, knowledge and information regarding water resources and the way to efficient use of water are not enough and timely disseminated to the households.

4.3.2.2. Forecast of potential for saving water in dried fish processing of the village

Based on the data collected and results of assessment, the potential for saving water in dried fish processing of the Binh Thang traditional craft village can be forecasted by comparison of water consumption levels among the households: highest level of water consumption with lowest level of water consumption (or best figure achieved) and average level of water consumption with best figures achieved.

Results of forecasting the potential for saving water in the dried fish processing of the village are presented in the table 4.3 and 4.4 below.

Table 4.3: Potential for saving water in dried fish processing: average level compared with the best

STT	Production size of the households	Water consumption for fresh fish (l/kg)		Potential of savings (%)
		Average	Best figures achieved	
01	Production yield < 100 kg/day	10.11	9.00	10.90
02	100 kg/day ≤ Production yield < 200 kg/day	8.79	7.30	17.00
03	Production yield ≥ 200 kg/day	7.26	7.00	3,58

Table 4.4: Potential for saving water in dried fish processing, highest level compared with the best

STT	Production size of the households	Level of water consumption for fresh fish (l/kg)		Potential of savings (%)
		Highest	Best figures achieved	
01	Production yield < 100 kg/day	11.2	9.00	19.7
02	100 kg/day ≤ Production yield < 200 kg/day	9.5	7.30	23.2
03	Production yield ≥ 200 kg/day	7.5	7.00	6,7

The forecasted results presented in the table 4.3 show that the households of all production size in the village could save water volume consuming for 01 kg fresh fish in dried fish processing about from 17.00% to 3.58 % if it is compared with average of level of water consumption in the village, among them the households which have production yield of from 100 kg/day to 200kg/day could save water consumption most and up to 17%. In relation to comparison of water consumption for 01 kg fresh fish in the processing between highest level and best figures achieved, the saving could be up to 23.2% and it is various from 6.7% to 23.2% as presented in table 4.4 above.

4.4. Measures proposing for reduction of water consumption level in the processing

Based on the results gained from the research implementation, there have been many reasons leading to waste of water in dried fish processing in the Binh Thang traditional craft village. In order to reduce the level of water consumption in the processing of the households in the village, especially the households having high level of water consumption, it could be proposed such measures as follow:

- Host of the production households need to educate and disseminate workers more details in technological process of dried fish processing, training workers in production manipulation and regularly monitor and correct them. The households need to apply solutions of water reuse and water recycle. The host of the production households could apply ecocouraged methods such as rewarding workers for activities of saving water and so on.
- The dried fish processing households of the village should: regularly organise meetings and together share their experiences in using water; develop cleaner production combination (group of households which has the same production process and common awareness on water saving) to exchange not only experiences but also 'know-how' if it is possible; and support each other in production.
- Regularly checking production instruments and equipping instruments for water measuring.
- Environmental management agency in the region should raise awareness of the households on water resource by increasing educated and trained courses regarding saving water.
- There is need to have economic and technical methods supporting the households to save water in the processing. The methods could be: technical support, including equipment and production tools, and funding for applying cleaner production solutions and make those households as demonstration units; enhancing propaganda and dissemination of methods for saving water in processing to the households in the village; encouragement to the households in reducing level of water consumption in processing by application of rewarding and recompensing mechanism.

V. CONCLUSION

From the results of the research “Study on proposing measures to reduce water use in dried fish processing in Binh Thang traditional craft village, Binh Dai district, Ben Tre province - Viet Nam”, some conclusions can be drawn, as follows:

- Most of the stages in dried fish processing in the village are manual, labor intensive, prolonged production time.
- Wastewater generated from the households producing dried fish products has high concentration of pollutants and it exceeds the existing regulation of Viet Nam.
- On average, water consumption level of the production households is quite high and the level is different from the households in the village;
- Levels of water consumption in the households are depended on production process as well as attitude, including awareness of the producers;
- The state environmental management as well as production management play important role in water consumption in the village.
- Internal and external factors much affect the level of water consumption in the dried fish processing in the village. Applying measures such as promoting awareness about water efficient use among the producers; enhancing propaganda and dissemination; and supporting economy and technique from government and management agencies could be very much effective regarding the water consumption.

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