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The Economy and Environment Program for Southeast Asia (EEPSEA) was established in May 1993 to support training and research in environmental and resource economics across its 9 member countries: Cambodia, China, Indonesia, Laos, Malaysia, Papua New Guinea, the Philippines, Thailand, and Viet Nam. Its goal is to strengthen local capacity for the economic analysis of environmental problems so that researchers can provide sound advice to pollcymakers.

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Helping Handicraft Villages Cleanup – An Assessment of Pollution Control Options in Vietnam

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Processing agricultural products is of the most important 'handicraft' activities in Vietnam's Red River Delta. It provides jobs, improves household incomes and helps alleviate poverty. However, it also generates a huge amount of waste and is a source of serious pollution. Now a new EEPSEA study has analysed the environmental consequences of agro-product processing in the area →

A summary of EEPSEA Research Report No. 2009-RR4: 'Pollution Control Options for Handicraft Villages: The Case of Duong Lieu Village in the Red River Delta, Vietnam' by Nguyen Mau Dung, Department of Economics, Hanoi University of Agriculture, Gia Lam District, Hanoi City, Vietnam.
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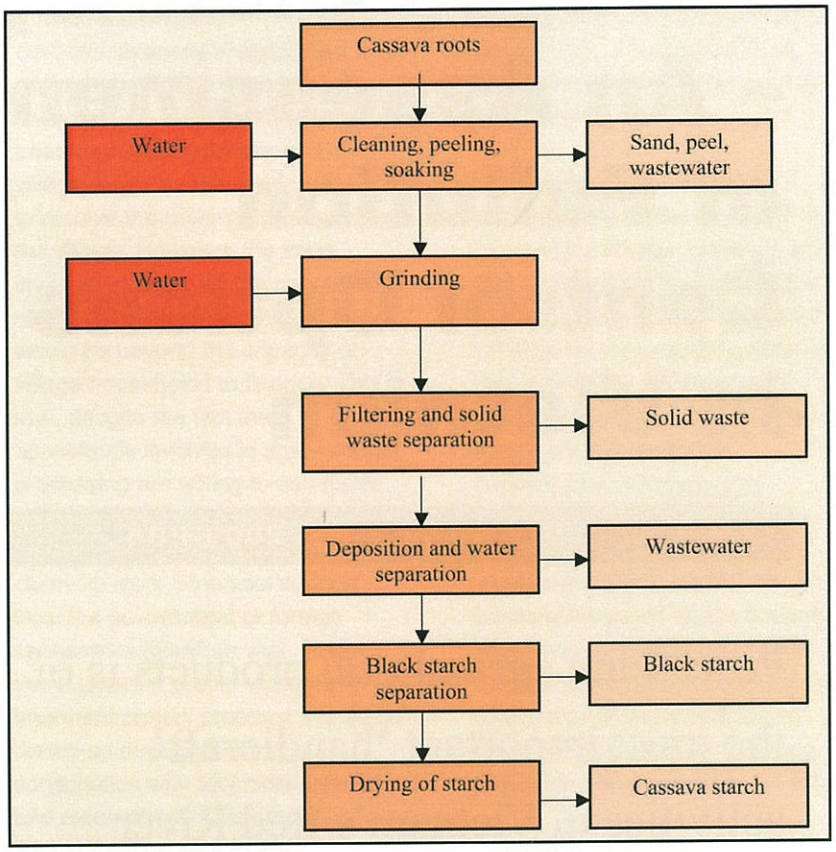
"a wastewater treatment plant should

Flow chart for the making of cassava starch



→ and assessed the cost-effectiveness of pollution control options.

The study, which is the work of Nguyen Mau Dung from Hanoi University of Agriculture and Tran Thi Thu Ha from Vietnam University of Forestry, looks at a village where most of the households are engaged in cassava starch processing. The researchers find that this activity is a significant source of pollution, which is seriously affecting the health of local rivers and local people. The study recommends that a wastewater treatment plant for the whole village is set up and that wastewater fees are collected from households engaged in agro-processing activities. It also recommends that the sewerage system in the village be improved, that households are involved in environmental clean-up work and that steps are taken to encourage cleaner production technologies in the agro-product processing industry.

Handicrafts in the Delta

More than half of the handicraft villages in Vietnam are located in the Red River Delta. In the Delta itself, Ha Tay Province is noted for its high density of handicraft villages and for the diverse range of handicraft products that its residents produce. Currently, there are 120 handicraft villages in Ha Tay Province. These are mainly involved in carpentry, weaving, lacquering, agro-products processing, rattan and bamboo handing, and metal recycling. Agro-product processing is carried out in 17 villages in the province. Twelve of these focus on starch and noodle production. Ha Tay was therefore selected as a representative province to investigate the environmental impact of agro-product processing.

The village of Duong Lieu in Ha Tay province was chosen as the research site. This was because it has a very high percentage of households engaged in starch processing activities and pollution in the village is at an alarming level. Agro-product processing in the village has had a long history – it started in the 1960s. At the time of the study more than 400 households in the village were engaged in the agro-processing industry, producing around 60,000 tonnes of cassava starch annually.

How to Clean Up Duong Lieu?

The overall objective of the study was to identify the environmental consequences of agro-product processing in Duong Lieu handicraft village and to assess the cost-effectiveness of different pollution control options. In other words, the researchers aimed to answer the question "What is the best solution to mitigate pollution in Duong Lieu Village?" The main environmental problem caused by agro-product processing is water pollution, so this was the study's focus. The cost-effectiveness of three wastewater pollution control options was evaluated: (1) a small treatment plant for every household; (2) a treatment plant for a group of processing households; and (3) a treatment plant for the whole village. An analysis of the social acceptability of the three options was also done through focus group

... be set up for the whole village."

discussions and a "voting game" in which each participant selected the most appropriate option from his/her individual viewpoint.

Secondary data on socio-economic factors, processing activities and environmental problems in Duong Lieu were gathered from available reports produced by various regional environmental agencies. In addition, primary data on processing activities and their environmental consequences was gathered through direct interviews with 102 small, medium and large-scale processing households and through focus group discussions. A technical expert was also invited to visit the research site to observe the processing activities, inspect the wastewater discharge, drainage systems, and pools and develop wastewater treatment options.

Pollution is a Key Issue

It is clear that agro-processing in Duong Lieu produces significant volumes of water pollution that is affecting the local environment. On average, one small-scale household discharges nearly 10 m3 of wastewater per day while medium and large-scale households produce 12.3 m3 and 21.8 m3, respectively. The concentrations of all key pollutants in the wastewater at all stages of processing were between 10 and 120 times above the national pollution standards. A large percentage (75%) of the villagers believes that many common illnesses in the village are linked to the serious pollution produced by cassava processing. Among the ailments linked to pollution were headaches, backaches, respiratory diseases, skin irritation, stomach aches, sore eyes and cancer.

Although the local residents in the village perceived wastewater and solid waste from agro-processing activities as environmental health hazards that need to be addressed, their awareness of the importance of environmental protection is still poor. Many processing households dispose of a mixture of untreated wastewater and cassava peelings directly into the village drainage system. They also dump their processing residues alongside local roads in a disorderly fashion; these residues sometimes fall into nearby drains and block them up, worsening the overall pollution situation. This is a major problem as the drainage system in the village was constructed in 1990 and has degraded considerably since then. The drains are now broken and badly clogged with waste in several places. This problem is exacerbated by the fact that the village's environmental sanitation team only clears drains once every three months. This is due to resource limitations.

Pollution Control Options

As already mentioned, three pollution control options were evaluated to see how cost-effectively they would treat the wastewater in the village. It is clear from this assessment that the establishment of a small treatment plant for each individual household would have the smallest treatment cost per cubic meter of wastewater (1,978 VND/m3). The next most cost effective option would be a treatment plant for the whole village, which would cost 2,008 VND/m3. The highest cost option would be a treatment plant for a group of processing households, which would cost 4,480 VND/m3.

The analysis of the social acceptability of the three options showed that a treatment plant for the whole village was the most culturally acceptable. Overall, given its high 'acceptance factor' it is clear that this option would be the most widely accepted because it would have relatively low treatment costs per cubic meter of wastewater and because enough space is available for its construction. There is also a higher likelihood of securing financial

Wastewater volume per day by household scale

Household scale	Mean (m^3)	Minimum (m^3)	Maximum (m^3)	Std. Deviation
Small-scale	9.67	5.00	14.00	2.60
Medium-scale	12.25	7.00	18.00	2.30
Large-scale	21.76	10.00	50.00	9.34
All	14.41	5.00	50.00	7.67

Source: field survey (2006)

support for this option and it is clear that if it is efficiently managed, it could completely solve the water pollution problem for the entire village.

The results of the cost-effectiveness analysis and social acceptability assessment show that the establishment of a treatment system for the whole village would be the most viable way to resolve the pollution problems in the village. However, the initial investment costs for the construction of this option would be heavy and would be beyond the capacity of village households to finance. This is true, despite the fact that households involved in agro-product processing are willing to contribute up to 10% of their annual income from processing activities to clean-up work. Financial support from the government or foreign sponsors is therefore vital. To get this support, a proper wastewater treatment project proposal should be drawn-up through further consultation with technical experts and researchers. This proposal should then be sent to the Department of Science and Technology in Ha Tay Province so that it can source for funding.

Paying for Pollution

Although Vietnam follows a polluter-pays approach to pollution clean-up, the processing households in Duong Lieu do not pay to discharge wastewater. This is because processing activities are performed by many small-scale households and the measurement of wastewater volumes from every household is therefore difficult. Without data on the wastewater volumes produced by the processing households, it is impossible to calculate the wastewater fees that they should pay.

However, the focus group discussions with the local staff in Duong Lieu Village, however, show that it is possible to estimate the volume of wastewater households produce as their monthly electricity use is linked to the amount of pollution they produce. Therefore, if a household's electricity consumption is known, the wastewater fee it should pay could be calculated. The collection of wastewater fees from the processing households would create a source of finance to support the operation of the treatment system and help raise awareness of the importance of environmental protection among the processing households in the village.

Given the low level of environmental awareness in the village, educating the villagers on environmental pollution, especially the processing households, is essential. Classes on pollution prevention and treatment should be held for the processing households. Moreover, an environmental education program should be developed and implemented to raise the villagers' understanding of environmental problems and solutions, especially regarding the wastewater produced in the village.

Future Options

To solve the problem of broken and clogged drains, the repair and improvement of the drainage system in the villages is necessary. To clean the drains more often, the participation of the villagers is also necessary. The Village Management Board should organize a collective village activity involving everyone in the cleaning of the roads and drains once a month.

Looking to the future, it is clear that cleaner production technology offers a long-term solution to the problems of agro-product processing in Duong Lieu Village and in other places in Vietnam that face similar problems. The goal of cleaner production is to avoid pollution by utilizing resources and raw materials to the maximum. This means that a higher percentage of the raw materials are turned into valuable products instead of being wasted. For cassava processing, cleaner production could be made possible by replacing old processing machines with modern ones, reusing the wastewater from filtering to clean cassava roots, and using cassava residues to produce bio-fertilizers or materials for mushroom cultivation. This approach should therefore be researched and plans made for its implementation.

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