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An Analysis on Existing Waste Management Condition and Cost Effective Process of Waste Minimization of Silk Industries: A Case Study on Rajshahi City

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Abstract

Rajshahi, the silk city of Bangladesh, has the highest dominant production in the sector of silk though the silk industries produce a large amount of waste. This study focuses on the existing waste management condition in silk industries and the cost effective process to minimize the wastes in silk industries. It shows that, 60% of silk waste like various salts, alkali, acid, Na_2S generates from dyeing process and about 30% of waste like colors, starch generates from printing process and remaining wastes generate from other processes. Again, there is no ETP of any industry and so wastes are disposed in open area. The major finding of the study is that, wastes can be minimized by reducing water consumption through repairing leaks, faulty valves which can minimize cost up to 15% of the total production process. Again reducing solid waste in the silk industries through reducing packaging materials can minimize waste and can save costs up to (10-15) % which will help to understand the existing waste management condition and the importance of waste minimization in the silk industries of Rajshahi for future improvement.

Keywords: Waste Management, Cost Effective, Dyeing, Printing, ETP

"1.Introduction"

"1.1 Background"

Waste generation is an inevitable part of every life and a human being ceases to generate waste only when he is no more or is to be disposed as waste (Tambe et al., 2016). The term "waste management" refers to the systematic approach consisting of collection, transportation and proper disposal of garbage, sewage and also discusses various solutions for recycling, specially putting the waste to productive use. Rajshahi, the silk city of Bangladesh, has the highest dominant production in the sector of silk. Inspite of high production rate in the economy, the silk industries produce a significant amount of waste. The waste treatment and management of BSCIC, Rajshahi does not follow any rule (Bari et al., 2016). There is no proper treatment process and there is no ETP in the industries. So the waste is open dumped and burnt. Poorly operated landfills and dumpsites cause a multitude of environmental problems for surrounding communities, including contamination of ground surface water by untreated leachate, emissions of airborne pollutants, and the spread of odours, flies, mosquitoes, rodents, dust and noise(Omran & Gavrilescu, 2008). As its consequences, it greatly affects the surrounding the area including the workers and the people who are directly or indirectly connected with the industries. This study focuses on waste minimization of silk industries as proper treatment of produced waste. It also focuses on cost effective process of waste minimization which can also save the total production cost of the industries.

“1.2 Objective”

The purpose of the study is to identify the existing waste management condition in silk industries of BSCIC industrial area in Rajshahi and to assess the cost effective process of waste minimization to reduce the waste generation to save overall production cost of the industry.

“1.3 Study Area”

The silk industries area are on BSCIC industrial area which is located on Sopura, Rajshahi, Bangladesh. The BSCIC industrial area is laying between latitude of 24.3872 north and longitude of 88.6038 east in decimal degrees. It is situated beside Rajshahi-Naogaon highway and on the other hand it connects with the cantonment road.

Fig 1.3 Study Area Map Source: Google Earth

“2. Methodology”

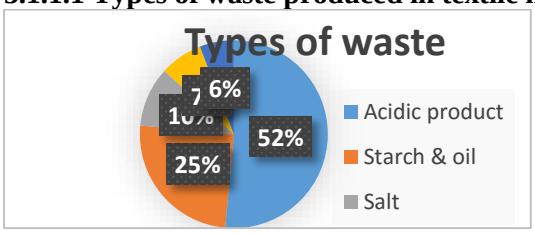
Primary data has been collected from field survey through questionnaires and field observations. In Rajshahi, due to lack of research and data related silk industries waste management, the data has been collected from expertise on that area. Secondary data has been collected from journals, BSCIC and newspapers. The sample size (68 respondents) has been determined from the silk industries through the simple random sampling with the 90% of confidence level. Collected data has been given input in Ms Excel and has been analysed through the statistical analysis. Pie charts and tables has been also used to represent the data.

“3. Result & Discussion”

3.1. Existing Waste Management Condition: The existing waste management condition refers to waste production in sericulture & textile manufacturing process. But in sericulture process the waste is produced in insignificant amount. The sericulture waste like silk pupae are used to feed fishes and broken cocoon are also reused by re-reeling process; so it has less impact on environment.

3.1.1 Waste production in textile manufacturing process

3.1.1.1 Types of waste produced in textile manufacturing process



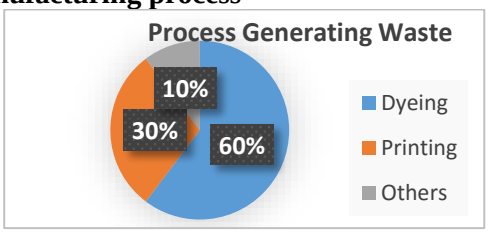


Fig 3.1.1.1 Types of waste produced in textile manufacturing process
Fig 3.1.1.2 Process generating waste in textile manufacturing process Source: Field Survey 2019

Textile manufacturing process refers to transforming the fibre obtained from reeling to the final product of silk cloth. It includes warping/beaming, dyeing, printing etc. processes. From the field survey, it can be clearly stated that mostly the waste from textile manufacturing process are acidic products or chemicals. There is also a

significant amount of starch & oil, salt, Na_2S waste are being produced. Besides, solid waste like matted yarn are also produced in textile manufacturing process.

3.1.1.2 Process generating waste in textile manufacturing process

From the field survey, it clearly stated that mostly chemical waste like acidic product, salt & Na_2S are produced in dyeing process. Again, it also shows that a significant amount of waste like acidic product, starch & oil also generates from printing process. Generally, the waste in dyeing process came from the color or dyes which is mixed with cloth in this process .The waste in printing process came from usually the color products and the starch & oil.

3.1.2 Treatment of produced waste

3.1.2.1 What happens to waste

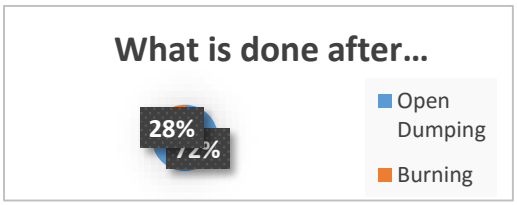


Fig 3.1.2.1 Work done after producing waste Source: Field Survey 2019

Waste treatment is very necessary to reduce the harmful effect of waste on environment. From the field survey, it has been observed that there is no treatment and no ETP on BSCIC industrial area. From the survey, the majority of the waste are open dumped. Besides, a significant amount of waste are also being burned.

3.1.3.1 Knowledge of waste affecting environment

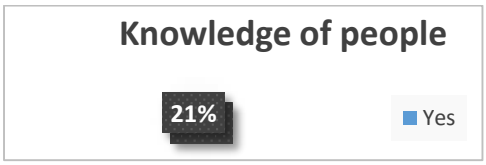


Fig 3.1.3.1 Knowledge of waste affecting environment Source: Field Survey, 2019

When the people of silk industries of BSCIC was asked about having the knowledge of effect of the produced waste, most of the people replied in positive. Again, some of the people of the silk industries also don't have knowledge about produced waste's effect on environment. It indicates that, people of the silk industries are mostly aware of the effects of waste on environment but they do not use proper treatment process to treat the produced waste.

3.1.3.2 Causes of waste treatment not being done

Fig 3.1.3.2 Causes of not treating waste Source: Field Survey, 2019

Though majority of the people of silk industries have the knowledge of produced waste effect on environment but they do not use any proper treatment for the produced waste. When asked about this, most of the people have said lack of proper management as the main cause behind this. Besides, many people also indicated lack of proper knowledge behind this.

3.1.4 Impact of silk waste on environment

Waste has a vast impact on environment. The textile manufacturing waste includes chemical components. The textile manufacturing process waste have large impact on environment as these waste are not treated properly. Besides, there is no ETP in industry area. Most of the chemical components produced from dyeing & printing process are open dumped. As a result it mixes with the freshwater when it is rain and washed away. For this reason, it also affects human and other animal's health by consumption of that water. Again, solid waste like matted yarn are burnt and it pollutes the air by producing harmful gasses. So, the waste produced in textile manufacturing process have huge impact on the environment.

Fig 3.1.4.1 Open dumping of wastewater Fig 3.1.4.2 Burning of solid waste
Source: Field survey 2019

3.2. Cost Effective Process of Waste Minimization: The cost effective process of waste minimization includes faults in processes behind waste produce, material production cost, produced waste cost.

3.2.1 Faults in processes behind waste produce

Fig 3.2.1 Faults in processes behind waste produce Source: Field Survey, 2019

From the field survey, it can be clearly stated that the solid waste are being produced mainly because of packaging materials such as matted yarn in packaging time. Again, chemical components are being produced mainly because of pipe leakage and in dyeing & printing. Again, significant amount of waste are also being produced because of machinery fault. So, in order to minimize waste these faults should be repaired.

3.2.2 Material cost production

The main products of silk industries are usually silk sarees and panjabis etc. According to Usha silk factory, about 180 gram and 77 gram of silk thread are needed to produce a 7 gauge saree and 3 gauge Panjabi respectively. The cost of each production process of saree are shown below:

Process	Cost(In BDT)
Silk thread	1700
Dyeing	400
Printing	400
Final Product including weaving	1200
Total	3700

Table 3.2.2.1 Cost of production process of each saree
Source: Usha Silk Industry, Field Survey, 2019

The silk thread of about 180 gram and 77 gram which is generally imported from usually China costs up to 1700 BDT and 730 BDT respectively. Then, the thread are then dyed and printed and then finally weaved to get final product and this whole process costs up to 3700 BDT(for saree) and 1600 BDT(for Panjabi).Approximately 1000 sarees and 1000 panjabis are being monthly produced in silk industries. So, average total monthly production cost of saree is (3700*1000) =3700000 BDT and average production cost of Panjabi is (1600*1000) = 1600000 BDT.

The cost of each production process of Panjabi are shown below:

Process	Cost(In BDT)
Silk Thread	730
Dyeing	200
Printing	200
Final product including weaving	470
Total	1600

Table 3.2.2.2 Cost of production process of each Panjabi
Source: Usha Silk Industry, Field Survey, 2019
So, average total monthly production cost of Panjabi is (1600*1000) = 1600000 BDT. So, average total monthly production cost of silk industries (3700000 +1600000) = 5300000 BDT.

3.2.3.1 Cost of chemical waste

Approximately color of 250 BDT (for each saree) and 150 BDT (For each Panjabi)are wasted. So, for 1000 sarees and 1000 panjabis about (250*1000) = 250000 BDT and (150*1000) = 150000 BDT amount of color are wasted in dyeing process. Similarly, color, chemicals of approximately 180000 BDT are wasted for 1000 saree and 100000 BDT are wasted for 1000 panjabis in printing process. The waste cost generating from each process of saree production are shown below:

Process	Cost (In BDT)
Dyeing	250000
Printing	180000
Others	35000
Total	465000

Table 3.2.3.1.1 Waste cost generating from process of saree production
Source: Sopura Silk Mills LTD., Field Survey, 2019

So, approximately colors, chemicals of 465000 BDT and 265000 BDT are wasted in overall production process of monthly saree and Panjabi production. The total waste cost generating from each process of Panjabi production are shown below:

Process	Cost
Dyeing	150000
Printing	100000
Others	15000
Total	265000

Table 3.2.3.1.2 Waste cost generating from process of Panjabi production
Source: Sopura Silk Mills LTD., Field Survey, 2019

So, total cost of products wasted in both saree and Panjabi production = (465000 + 265000) = 730000 BDT approximately.

3.2.3.1.1 Cost effective process

Chemical products like dyes which contains acidic products, salt, Na_2S, starch & oil are wasted from both saree and Panjabi production are approximately of 730000 BDT. By minimizing the waste through repairing faulty valves, pipes costs only 20000-30000 BDT. By minimizing these waste overall production cost can be also reduced which is shown below:
For 5300000 BDT of production cost approximately 730000 BDT waste cost can be reduced. So, for 100 BDT of production cost approximately ((730000*100)/5300000) = 13.77 or 14 BDT waste cost can be reduced. So, by reducing water consumption through repairing faulty valves, pipes can reduce the cost of total production up to 14% to 15%. As a result the waste specially chemical waste can be minimized and it can save total production costs upto 14% to 15%.

3.2.3.2 Cost of produced solid waste

According to Sopura Silk Mills LTD. average waste produced in per kg of yarn = 140 gram .Again, per saree is got from 7 gauge or approximately 180 gram of yarn or silk thread.So, an average of 1000 gram of yarn produce

140 gram of solid waste. Thereby, 180 gram of yarn produce ((140*180)/1000) = 25.2 gram of solid waste (for saree) and similarly 10.78 gram of solid waste (for Panjabi). So, approximately 25.2 gram of solid waste are produced from per saree. Therefore, 1000 sarees produce (1000* 25.2) = 25200 gram of solid waste. Again, 180 gram of yarn produce 1 piece saree. So, 25200 gram of yarn can produce (25200/180) = 140 pieces saree. Again, the cost of producing per saree is 3700 BDT. So, the cost of producing 140 pieces of saree (140*3700) = 518000 BDTSo, yarn of approximately 518000 BDT are produced as waste from monthly production of sarees. Again, the cost of producing per Panjabi is 1600 BDT. So, the cost of producing 140 pieces of Panjabi (140*1600) = 224000 BDT. So, yarn of approximately 224000 BDT are produced as waste from monthly production of panjabis. So, the total yarn produced as waste from monthly production of both sarees and panjabis are of approximately (518000 + 224000) BDT = 742000 BDT

3.2.3.2.1 Cost effective process

For 5300000 BDT of production cost approximately 742000 BDT waste cost can be reduced. So, for 100 BDT of production cost approximately ((742000*100)/5300000) = 14 BDT waste cost can be reduced.So, by reducing solid waste through reducing packaging materials through proper maintenance and reusing the solid products can reduce the cost of total production up to 14%. As a result the waste which is solid waste can be minimized and it can save total production costs up to 14%.
So, from the data analysis, waste should be minimized by reducing water consumption through repairing faulty valves, pipes which can also minimize cost up to 15% of the total production cost. Again reducing packaging materials by proper maintenance and reusing the solid products which can also minimize cost up to (10-15) % of the total production cost.

“4. Conclusion”

The waste from sericulture are produced from reeling process though it has been reused but the waste generating from textile manufacturing processes such as in dyeing & printing are not treated properly. It has been also analysed that the wastewater containing chemical components are openly dumped and the solid waste like matted yarn are burnt down. As a result, it has been affecting the environment as well as human life through consumption of wastewater which has been mixed with fresh water. However, it also focuses as waste treatment is not available so waste must be minimized and for this reason cost effective process can be used. For this reason, it has been analysed that, by repairing the faults such as repairing pipe leaks, faulty valves can reduce water consumption and by reducing packaging materials can reduce solid waste and can save costs up to respectively 15% & (10-15)% . As a result, it can lessen the effect of silk waste on environment and can also save production cost of the industries and can contribute in economic development of the country.

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