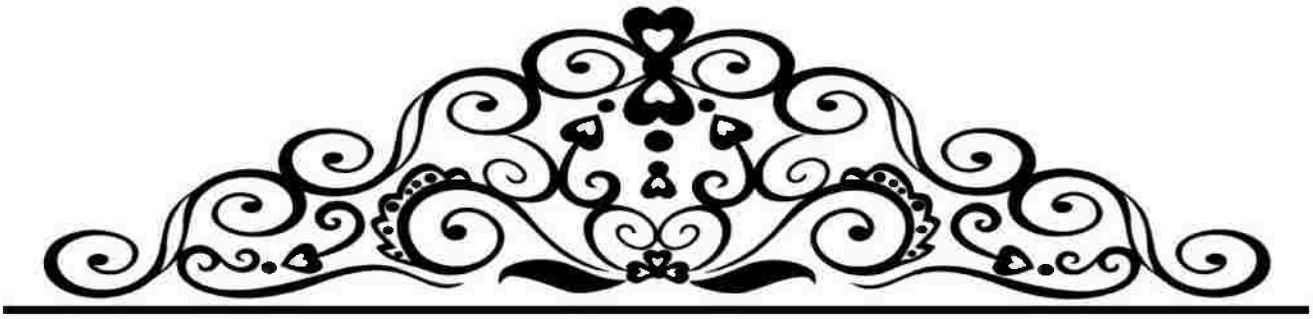
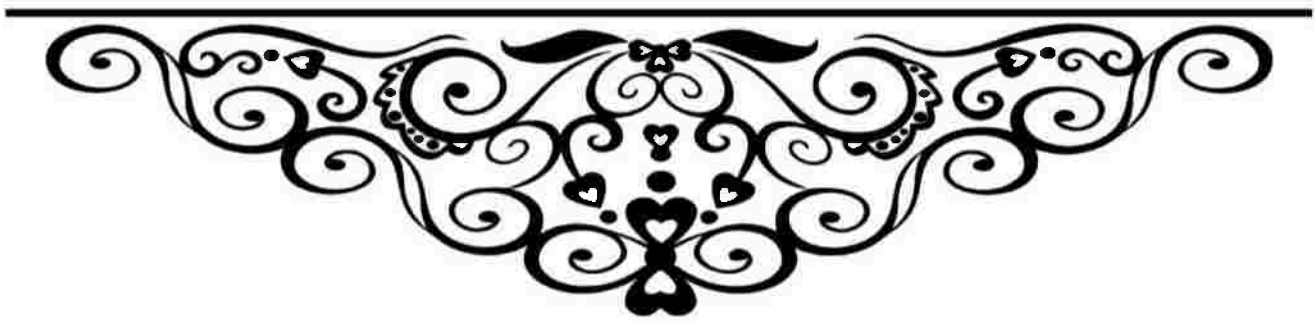


Introduction



1. INTRODUCTION

Earth contains an estimated 1351 million cubic km of water. Only 0.003 percent of this is classified as fresh water resources, that is, water that can be a source for drinking, hygiene, agriculture, and industry. Most fresh water is remote from civilization or too difficult to capture for use. The Food and Agriculture Organization of the United Nations (FAO) estimates that only about 9000 to 14000 km^3 are economically available for human use each year (FAO WATER, 2008) [1].

Egypt has been listed among the ten countries that are threatened by water scarcity by the year 2025 due to the rapid population increase. Water resources in Egypt are limited to the Nile River, rainfall and flash floods, deep groundwater in the deserts and Sinai, and potential desalination of sea and brackish water. Each resource has its usage limitation, whether these limitations are related to quantity, quality, space, time, or exploitation cost (Abdel-Shafy and Aly, 2002; Abdin and Gaafar, 2009) [2, 3]

More than 96 percent of all the Egyptian fresh water resources are supplied by the river Nile, which originates from outside the country boundaries and supplies ten countries among which Egypt. Egypt's share of Nile water is limited according to the 1959 international agreement between Sudan and Egypt at 55.5 BCM (Abu-Zeid, 1991) [4].

Water is a vital component for many industrial operations, and is utilized for a wide range of purposes in industrial processes. The rapid growth in population, coupled with industrialization and urbanization, resulted in an increased demand for water, leading to serious consequences on the environment (Dakwala *et al.*, 2011) [5].

Industry is a significant engine of growth providing 48 percent of gross domestic product (GDP) in East Asia/Pacific, 26 percent of GDP in lower-income countries and 29 percent of GDP in higher-income countries, although this last figure is declining. Much industrial activity in middle- and lower-income countries is accompanied by unnecessarily high levels of water consumption and water pollution (UNESCO, 2006) [6].

Food industry is one of the most important and oldest industries. The majority of food processing facilities are characterized by very high water consumption and high organic strength wastewater generation. The sector consumes 46% of raw water and generates 50% of wastewater. Wastes from food industries have similar characteristics, a) the presence of organic materials as proteins and carbohydrates, b) suspended solids, c) high biological oxygen demand (BOD) and chemical oxygen demand (COD), d) high nitrogen content, and e) high oil and grease content (Mori, 2003; El-Kady, 2010) [7,8].

Starch is one of the most common substances existing in nature and is a major carbohydrate easily extractable from various native sources, like potato, maize, corn, wheat, rice and cassava. Industrially, its applications are numerous, and it is used in more than 300 modern industries, including the manufacture of textiles, paper, adhesives, Insecticides, paints, soaps, explosives, and such derivatives as heat resistant adhesives, nitro-starch, dextrose, glucose and fructose. In recent years such derivatives as heat-resistant adhesives, esters comparable with cellulose esters, carboxylic acids from the oxidation of dextrose, and wetting agents have been produced (Kalvani *et al.*, 2012) [9].

Rice starch manufactures are one of the food industry sector, rice and broken rice are the raw materials. The production processes consumes and discharge large amount of water and wastewaters respectively. Compared with maize and wheat starches, isolation of rice starch is difficult and therefore costly because of its relatively high product cost, which is connected with long-term soaking and intensive washing procedures needed to remove residual sodium chloride and wastewater treatment. Rice starch isolation is different from other starches because of its unique protein composition. Approximately 70% of rice protein is soluble in alkali (pH>10) and in acid (pH<3) (glutelin) and 20% is soluble in ethanol (prolamin) (Seoul *et al.*, 1999) [10].

One of the solutions to the problem of feed crisis is the use of unconventional feed resources like crop residues and agro-industrial by-products. Organic residues from the industrial sector are usually among the most bulky of solid wastes and the most serious sources of water pollution (largely through their depletion at dissolved oxygen). However, they can be used as feed stock for the manufacture of animal feed, packing material, chemicals and pharmaceuticals, fuel, fertilizers and construction materials. Wastes from many agro processing industries can be valuable feed stock for other industrial operations (El-Alem, 1997; Oladunjoye *et al.*, 2010) [11, 12].

Feed is one of the important production inputs that affect the size of livestock production, which occupies the first place among the factors of production; its value reached about 23 milliard pounds representing about 58.3% of the total value of agricultural production requirements in 2008.The demand for feed derived from the demand for animal products such as red and white meat, fish and dairy products. The total livestock in Egypt, according to the report of the Ministry of Agriculture and Land Reclamation at 2010 are 4,728,721 head of cow, 3818236 head of buffalo, 5,529,529 head of sheep, 110,571 head of camels and 4,174,986 head of goats. The gap between available and required amounts of animal feeds in Egypt was calculated to be 9 million tons per year. Feed crops have an important place among the agricultural crops and represent about 30.4% of the area of winter crops, about 4.5% of the area of summer crops, and about 9% of the area of Nile crops, while the total area reached about 2458 acres throughout the year and represent about 16% of the total crop area in 2008 (Moussa *et al.*, 2011). [13]

The total numbers of factories producing feed in Egypt are 152 factories. The total full production capacity is 4,911,006 ton, the actual production is 1,376,340 ton and the deactivated capacity is 3,534,667 ton (Egyptian Ministry of Agriculture, 2010). [14]

Egyptian Starch, Yeast and Detergent Company are one of the subsidiaries of Food Industries Holding Company, produces starch from broken rice, the production process consumes and discharges large amount of water and wastewater respectively. The effluent wastewater from starch factory contains high loaded of organic matters. The wastewater goes to the anaerobic treatment unit without any utilization. Therefore the objective of this research is to reduce production costs by reduce the amount of water consumption in industrial processes; study the possibility of recycling water and raise the company's revenue by using the separated organic matters as additives for animal feed .

1.1 Aim of the work

The present work aimed to study:

1. Water consumption and wastewater generation in rice starch plant to assess the possibility of reducing them for decrease the production cost.

2. Separation of proteins and other organic wastes from wastewater.

3. The possibility of using organic extracts which contain a high proportion of proteins as new by-product for animal feed to raise the company's revenue.