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Processing industries: valuable strategy for reducing rice losses

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ABSTRACT: Reduction in rice losses can indirectly leads to decrease in production costs and increase in farmers' income as well as in production rate. To obtain this aim, processing stage should be of concern in addition to use of modern technologies during planting, growing and harvesting operations. Integrated industry is an important step for optimum use of rice losses. In addition to rice which is the major product of rice farming, its byproducts such as paddy stalk, rice bran, broken rice and straw are of commercial and economic potential. In this overview, use of various technologies in rice processing industries in order to process the rice byproducts will be investigated.

***Keywords*:** Broken rice, integrated industry, paddy stalk, rice bran, straw

INTRODUCTION

Rice is the second major food in the world. More than 90% of world rice production is produced and consumed in Asia. In Iran, rice product is the second high-consuming product. Like any other crops, rice undergoes quantitative and qualitative losses. These losses are produced during planting, harvesting and processing. Moreover, inappropriate use of losses and byproducts of rice is another cause of the reduced production. Thus, in order to enhance farmers' income, processing rice grains and using rice losses is necessary. Today, in developed countries rice losses are used for producing industrial, pharmaceutical, cosmetic and food products using modern technologies. In this overview, in addition to rice, economic and commercial applicability of other byproducts including rice bran, paddy rice, broken rice and straw are explored (Toriyama et al., 2004).

RICE

Beside rice which is commonly used, products such as canned rice, parched rice, instant rice, puffed rice and parboiled rice are also produced. For instance, canned rice is a processed product of rice. To produce canned rice, rice is baked and then sealed and sterilized under high temperature. Instant rice is another example. To prepare instant rice, rice is washed, soaked in dilute acetic acid solution, steam-baked, distributed on a mesh and hot-air dried at 80 - 100°C for 2-3 min. In this method, alpha-amylase is obtained which absorb water readily during consumption. For consumption, it can be mixed with hot water (Bao and Bergman, 2004; Toriyama et al., 2004; Rewthong et al., 2011).

RICE BRAN

Rice bran is a byproduct of rice production industry which composed of 11-17% protein, 13-18% fat, 10% fiber and 45-65% carbohydrate. It is used for producing concentrate for livestock feed, rice bran oil, phytic acid, calcium phytate, ferulic acid and protein rice bran powder. Rice bran oil is an important product among processed products of rice bran. This oil is of high nutritional value due to containing essential fatty acids, tocopherol, tocotrienol, 4-hydroxyl -3- methoxy cinnamic, squalene, natural antioxidants and ideal proportions of saturated fatty acids and unsaturated fatty acids known as healthy oil. Bran oil contains different natural antioxidants such as vitamin E and

oryzanol which leads to a high oxidative stability and prevents from oxidative decay. Refined bran oil with bright color and desirable flavor is appropriate for producing cosmetics such as sunscreen creams. This oil is also used for frying and producing mayonnaise, margarine and salads. Rice bran oil is available at market as raw oil, semi-refined and refined oil (Qureshi et al., 2000; Minhajuddin et al., 2005). Further, it is used in broilers food rations. Although rice bran contains nutrients such as vitamin B and amino acids as well as minerals such as phosphorus, potassium, iron, cobalt and zinc. Some anti-nutritional substances present at rice including lipase, phytic acid, trypsin inhibitor and haemagglutinin decrease nutritional value of rice bran. To improve nutritional value of rice bran and to destroy its anti-nutritional structures, different chemical treatments are used (Khan, 2003; Khan, 2004).

PADDY RICE

Paddy rice is the farthest outside part of rice which is used for production of pozzolana fillers, livestock feed, zeolite and ion exchange resins, various industrial composites, cofilter for juice production, active black and white carbon and soluble or insoluble silicates.

Although paddy rice has not food applications, it is a valuable raw material for producing various industrial and building products. For instance, raw materials such as paddy rice are used for producing compressed boards. There are three thermal-mechanical processing methods for producing compressed boards including resin-free method, application of formaldehyde resin and use of filling substances and silicate adhesives. The main procedures carried out in compressed boards processing include cleaning raw materials (paddy rice husk), mixing with resin and required additives, molding, hot-pressing, sanding and trimming, polishing and sharpening the edges of produced boards. Some appropriate properties of the chipboard produced from paddy rice husk compared with the chipboard produced from wood are as follows: resistance to damage, decay, fire, moisture and wearing, flexibility and durability as well as appropriate mechanical and elastic characteristics. Paddy rice husk chipboard is used for making indoor and industrial floors, wall panels, doors, windows and table (Shukla and Ojha, 1983).

On the other hand, the ash obtained from paddy rice is an effective alternative for cement consumed at concrete formulation due to inexpensiveness, ease of availability and appropriate technical properties. Regarding that cement industry is one of the most practical and costly industry, several studies have been done to find appropriate alternatives for consumed cement. In this regard, use of agricultural wastes and byproducts can be a useful alternative. Use of the ash obtained from paddy rice known as Pozzolana for producing composite cement leads to improvement of concrete engineering especially rheological and mechanical characteristics due to presence of about 22% silica in its structure. Paddy rice ash replace cement at about 40% (w/w) as pozzolana in composite and hydraulic cements. In bulk concrete-making, which needs controlling hydration temperature, the paddy rice ash is used under slow hydration and low temperature. The ash increases effectiveness and stability of concrete and decreases production cost. Also, this substance enhances concrete resistance to acidic conditions. There are different methods for producing concrete from paddy rice ash. They include Carbbean, standard, outdoor and indoor processing (Nicole et al., 2000; Della et al., 2002; Chandrasekhar et al., 2003; Rodriguez de Sensale, 2006; Nair et al., 2008).

BROKEN RICE

Since technologies used at rice factories of Iran are very old, losses due to breaking of rice are formed in conversion stage. These losses are called broken grains of rice which are used in different industries. For instance, one of the most high-consuming food products among people is starch which has food applications along with industrial use. Starch is commonly derived from wheat and corn; however, derivation of starch from rice broken grain is very economical. For doing so, rice grains are soaked into 3-5% NaoH for 24 hours, grinded by wet mill and filtered through a filter of 70-80 mesh. The leachate obtained from filter is then centrifuged and the obtained substance is neutralized by an edible acid until pH is reached to 7. It is then washed by distilled water and after drying, the two starch products namely starch flour and starch clod are presented to market. Starch derived from rice broken grains is used for producing photography papers and cosmetics and as fat replacer, thickener in sauces and ready-to-eat soups and as an ingredient for baby foods (Schoch, 1967; Alexander, 1995; Singh et al., 2000; Bao et al., 2007).

STRAW

Rice straw is used at packaging industry, livestock ration as enriched food, making compost, producing ethanol and high quality woods, growth medium for pearl mushrooms, fuel, soil coating in rainy days and as stuff for building straw mud constructions (Kargbo et al., 2009). Researchers have studied physical and chemical properties of rice straw and believe that this substance can be used as a recyclable source of energy. Special processing

techniques are used to overcome structural limitations of this product. One of these limitations is significant amounts of alkaline compounds. Using modern technologies enhances energy conversion and combustion yield as well as improving physical and chemical characteristics of straw (White et al., 1975; Su-ramaythangkoor and Gheewala, 2010).

CONCLUSION

Waste production is an important challenge of rice-farming. Regarding that a major part of rice-farming losses is related to rice-milling industry and that rice-milling by-products are not profitable in practice, improvement and optimization of rice-milling industry is necessary. Authorities' support for stockholders in order to establish integrated industries, standardization of processing procedures and codifying directions for investigation of rice losses are appropriate ways of decreasing production losses. With the use of integrated processing industries, production costs can be reduced which in turn enhances the rice production indirectly.

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