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CHEMICAL AND TECHNOLOGICAL STUDIES ON PREPARING EDIABLE PROTEIN PRODUCTS FROM CITRUS SEEDS

BY

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1. INTRODUCTION

The major citrus growing areas in Egypt are concentrated in the delta of the Rriver Nile as well as the new reclamated lands in the west desert. The total caltivated citrus area is about 335,000 Feddan. Actualy this area represents about 50% of the total fruits cultivated land. The total production of citrus in Egypt reaches about 2,225,000 Metric ton. About 200,000 MT are exported to abroad. (Ministry of Agriculture, 1992).

At present time citrus fruits are processed to produce juice and the wastes of this industry such as peels, seeds, pulps and ranges represent about 50% of the raw processed fruit (Ben-Gern, 1967).

Hendrickson and Kesterson (1965) reported that citrus by-products, which represent between 45 to 58% of the original material before juice extraction juice, can be classified into 3 main groups; (1) animal feed, (2) raw material suitable for production or recovery of valuable materials; and (3) food products.

These waste materials are dumped on nearby lands and cause a serious disposal problem. This enormous proplem should immediately establish a citrus by-products industry.

With the increase in world population and the existing shortage of high quality low-coast food necessitate the recovery of nutrituents from present waste sources and their utilization as food or as feeds. Such practice will help in reducing the gap between the increased world population and world food supplies.

It has been stated by Kramer and Kwee (1977c) that only 20-30% of plant materials grown in Unitied States are utillized directly for human

consumption. If the remaining portion of these materials, or even part of it, can be converted into neutrients for food, feed or even fertilizer this acutally represent a good contribution to food industry and minimize the polution problem of citrus industry.

In Egypt the seeds remained from citrus industry have no use except those of citron that are mainly used as root stocks. However, the potential application of such seeds in foods should be examined throughly before its utilization.

Citrus seeds has an excellent amino acids profile as reported by Braddock and Kesterson (1972), Ory et al. (1978) and Mostafa (1987). Defatted grapefruit as well as orange seeds were used to improve the nutritional quality of peanut meal through blending (Ory et al., 1978; Mostafa, 1987; and Rahma, 1988a).

2. THE AIM OF RESEARCH

The research on some different citrus seeds in this thesis was carried out to investigate the following aspects:

1- To evaluate the seeds nutritional value. Also, functional properties, and gel electophoresis pattern of raw materials was also conducted.

2- Physicochemical characterisation of seed proteins was performed.

3- Characterisation of the oil fraction as well as fatty acids profile were determined.

4- The defatted seeds flours were used in some food products and evaluated organoleptically.

3- REVIEW OF LITERATURE

3.1. Physical properties of citrus seeds:

Deriggers et al. (1951) reported that approximately one pound of seed can be secured from each box of processed oranges or seeded grapefruit. The seedy varieties of citrus contain 3.5% seed (Joslyn, 1961). Abdel-Baki and Hassan (1970) reported that orange seeds constitute 1.9 to 9.8% with an average of 5.38% of the orange wastes. Tsuyuki et al. (1984) found that the seed index of Japan citrus varieties was ranged from 16 gm to 18 gm for each 100 seeds. On the other hand, Fong et al. (1993) showed that seed index of valencia orange was 26.3 gm and the average number of seeds per fruit was 6.5 gm.

3.2. Chemical composition of citrus seeds:

3.2.1. Moisture:

Loba et al. (1950) found that the moisture content of sweet orange seed was 6.07%. Zaganiaris (1958) reported that the moisture content of orange seeds was 14.05%. Ammermann et al. (1966) mentioned that the moisture content of citrus seeds was 10%. Moharram (1980) reported that the moisture content of orange seed and orange seed flour was 10.32% and 10.75%, respectively. Moussa (1990) reported that the moisture content of lemon seed and lemon seed flour was 10.32% and 10.75%, respectively.

3.2.2. Total protein:

Jane (1952), McCready and Owens (1954) and Parekh et al. (1959) reported that the citrus seed flour was considered a valuable feed for poultry, due to its high protein content of 35.5%. Ammermann et al. (1966) found that the citrus seeds contain 14.6% protein. Abdel-Baki and Hassan (1970) mentioned that the orange seed flour contained 28.3% protein. Moharram (1980) reported that the protein content was 17.37% and 28.97% for orange seed and orange seed flour respectively. Kamel et al. (1982) indicated that citrus seed had 16.1% protein. Also, Lazos and Servos (1988) reported that the orange seed flour crude protein content was 16.6%. Moussa (1990) reported that the lemon seed and its flour had 18.48% and 24.79% protein, respectively.

3.2.3. Total ash:

Loba et al. (1950) found that the orange seeds of Eastern Spain variety contained 3.3% ash. Abdel-Baki and Hassan (1970) reported that the ash content of the Egyptian orange seeds was 3.72%. Also, they added that the meal contains 1.64% Ca, 0.38% P, 0.42% Na and 0.05 K. Abdo (1977) reported that the elements content of orange seed flour was 0.19% Na, 0.67% K, 0.46% Ca, 0.09% Mg and 0.41% P. Kamel et al. (1982) mentioned that the elements content of citrus seed was 100 K, 21.15 Fe, 240 Mg, 480 Ca, 250 P, 1.93 Cu and 2.25 Zn mg/100 gm sample. Lazos and Servos (1988) reported that the ash content of orange seed was 3.64% and contained a considerable amounts of minerals, K, Ca, Mg, Fe, Zn, Mn and P. Moussa (1990) reported that the ash content of lemon seed was 3.78%. Also, the major minerals of