STUDIES ON INSTANT SOLUBLE COFFEE

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T H E S I S

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INTRODUCTION

Soluble coffee is made by extracting roasted coffee powder with water in a series of percolator at suitable temperature and drying the extract to a solid powder. Furthermore, instant coffee is a convenient food compared with brewed roasted coffee. It minimizes consumer attention for its preparation, eliminates cleaning after preparation, reduces product waste, and does away with investement in and maintenance of brewing device (Sivetz, 1963 and Mitral et al. 1964).

The history of instant coffee extends back almost 100 years and the product has been produced commercially for approximately 60 years. However, its developments remained dormant until world War II and its Spectacular growth has been during the past 20 years. Within this short period of time, quality has been improved to the extent that the product has gained almost universal acceptance by the consumer. In direct comparison with regular coffee, for 1961, approximately 20 per cent of all the green coffee imported into the United States was

used in the manufacture of instant coffee, and 30 per cent of all coffee consumed was "instant", (Van Arsdel 1964).

In Egypt the instant coffee has relatively wide use in air service commerce, hotels and by some Egyptian consumers. The cost of the imported instant soluble coffee in 1969 was 27000 $ (in hard currency)*.

The industerlization of instant coffee in Egypt is practically nil and such a problem needs the attention of the authorities in Egypt, especially those interested in food technology. Instant coffee is imported from foreign countries and this proved to be costly when the payment to be considered in hard currency.

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* Special communication with Supreme Organization of Drugs.

AIM OF INVESTIGATION

The present investigation represents an attempt to prepare and characterize the soluble coffee in Egypt, and it seems advisable to refer to the main points under investigation which include the following:

(1) Chemical constituents of the green coffee used for the production of the soluble coffee.

(2) A study of the possibility of producing spray-dried soluble coffee.

(3) Quality measurements of the produced soluble coffee in comparison with the genuine samples.

(4) Agglomeration and aroma improvement of the produced instant soluble coffee were also studied.

REVIEW OF LITERATURE

The literature on the subject of coffee is so enormous that it can hardly be covered in this thesis, however the literature concerning instant coffee is somewhat scanty and what had been mentioned in this respect is mostly in form of patents. The most closely related points are cited:

A. Raw material:

There are three basic types of coffees which are being used in the majority of instant coffees that are currently being marketed, namely, Brazilian coffee, high grown mild from Central America, and Robusta-type coffee from Africa (Van Arsdel 1964).

Brazilian coffees are classified into four great group, namely Santos, Rio, Victoria, and Parana. Among the Brazilian coffees Santos is the most popular due to its Sweet, clear, flavour. Rio has a pu pungent flavor and aroma which may be considered undesirable. Paranas has a good flavor and is similar to Santos. Coffee varieties from Central America are Mexican, Guatemalas, Cobans, Antiguas,

Salvdors, and Nicaragua. High grade of African coffee are grown in Kenya, Tonganika, Belgian Congo, and Ethiopia. (Merory, 1960).

The classification of the chemistry of the green coffee has already been made into generally recognized groups of organic compounds and these are oil, proteins, caffeine and ash (Sivetz, 1963). It was found that the fat content of the green coffee ranged from 10.0 to 17.4% (on dry weight basis) according to the variety (Slotta and Neisser, 1939, Thaler and Gaigl, 1962, Tango and Carvalho, 1963, and Sivetz, 1963).

Green beans contains from 12.44% on dry weight basis protein (Hesse, 1911, Slotta and Neisser, 1939, and Sivetz, 1963).

According to Bertrand and Bertrand, (1944), the ash content of green coffee beans ranged from 3.62-5.09%, (Sivetz, 1963) stated that, the ash of the green beans was 4.0%.

The maximum caffeine content of coffee is between 1.2% and 1.7% (Lendrich and Nottbohm,1909,

Venkatachalam and Sundram, 1953, Tango and Carvalho, 1963 and Sivetz, 1963).

Carbohydrates represent the longest protein of the green coffee beans about 50-60%. Wolfrom et al., (1960) found that the soluble sugars of green coffee were sucrose 6-7% and trace of glucose. Slotta and Neisser, (1939) stated that the green coffee contained 1% reducing sugars and 6.4% sucrose.

Usually blending of green beans is followed to insure uniformity of quality and costs and the most common method of blending is to dump a pre-calculated ratio of various coffees directly from the bags into the blender, (Merory, 1960 and Van Arsdel, 1964).

B. Instant soluble coffee production:

1) Roasting:

It is essential to remember that the flavour of coffee is developed by roasting and therefore, this is a key step in the process of producing good instant coffee. In addition to creating flavour

by causing chemical changes to occur within the beans, roasting also affects subsequent extraction and drying techniques. Dark roasts soften the bean, render it more readily extractable; on the other hand, dark roasts release more oils, which inhibit extraction and influence spray drying. Dark roasts produce a more brittle bean, which gives a wider particles distribution when ground and, in conjunction with cellular softness, often causes extraction difficulty due to excessive packing within the per-colators. Light roasts do not adequately develop coffee flavours, yields tend to be lower, and final product color are inferior, (Van Arsdel, 1964).

Both continuous and batch-type roasters are commonly used throughout the industry. The range of roasting temperatures commonly used for instant coffee production would fall between 390°F. for the light roast and 460°F., for the dark roast. The roasting cycle in a four-bag, batch type roaster is about 15 min. A dark roast would take approximately 1 to 2 min. longer than light roast. At the end of the roasting process the coffee beans are then

immediately discharged from the roaster into an air cooler where the temperature of the coffee is further reduced to approximately 100°F. Roasting breaks down and opens up the bean cell structure. (Sivetz, 1963). Analysis of roasted and unroasted coffee indicate that marked changes take place during roasting but that the constituents are not dissipated. There is a transformation into substances which contribute to the aroma of the roasted product. (Hagen, 1922).

Trigg, (1918) stated that fat serves to retain aroma in the beans, and its decomposition products in form of aromatic constituents.

During roasting a part of sucrose was hydrolyzed to fructose and glucose (Wolfrom, Pinnkett and Lever, 1960).

Sivetz, (1963) stated that, sucrose in green coffee is altered to simple, carmelized, and decomposed sugar products. The sucrose is first partiel dehydrated, then hydrolyzed to reducing sugars as the temperature rises to the pyrolysis point. Then the

reducing sugars are dehydrated, polymerized, and partly degraded to volatile organics, water and CO_2 gas. Some pyrolysis products react with proteins and degradation products to form other coffee substances.

Roasting green coffee denatures most of the protein. Roasting renders protein less water soluble and amorphous. Some large protein molecules partly break down (Sivetz, 1963) and the free amino acids disappeared on roasting (Wolform et al.,1960). Lendtrich and Nostbohm, (1909) observed that the caffeine content varied from (1.07 to 1.51% in the raw coffee and 1.16-1.72% in the roasted products.

2) Extraction:

The general method for producing powder soluble coffee is to extract the drinking properties from ground roasted coffee by means of water, and to evaporate the resulting liquid until only the powder is left. There are number of extractors in operation to-day. The most popular being the percolator extraction which is used by most manufactures