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PRODUCTION OF EDIBLE SYRUP FROM MOLASSES**

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S U M M A R Y

Molasses produced by a local sugar refinery was analysed for sucrose and ash contents. Investigation of various metals in the molasses was carried out using Flame Emission Spectophotometry (FES) and Atomic Absorption Spectrophotometry (AAS).

Removal of the metallic ions by column chromatography in a preparative scale was carried out and yielded an encouraging result. A commercial process for desugarizing molasses was suggested.

Introduction

Molasses is the by-product of processing sucrose in cane refineries. It is the final effluent and residual syrup from which no crystalline sucrose can be obtained by simple means (1). The final molasses from the centrifugal plant is a too heavy and too viscous syrup with a composition, shown on Tab (1), that varies with soil and climatic conditions. The estimated quantity of molasses produced in the Sudan in 1985-1986 was approximately 2.0 x 10^6 tons (2) Very little of this quantity was utilized and the rest was discharged into the river.

Usually molasses can be diversely utilized. For example, it can be used as fertilizer, animal feed, and indirectly for the production of spirits, alcohols, vinegars, acetic acids and baker yeast.

The Finsugar and Zuzucker processes (3) are two such well-known methods of chemically and physically recovering sugar from molasses. It seems, however, that these processes for desugarization of molasses are more expensive than the usual methods of refining sugar cane and beet juice. At present, sugar is a rare commodity in Sudan. Although Sudan produces and imports sugar, the supply is still short of demand. Sugar on the black market sells for prices ten times that of the usual price. Therefore, in places like the Sudan, it is worthwhile to tackle the molasses to increase the availability of sugar.

The objective of this research is to investigate ways to utilize molasses to obtain a syrup fit for human consumption.

Desugarization of molasses

To render the raw molasses fit for human consumption, some of its constituents must be removed. These unwanted constituents are mainly inorganic ashes. Table (1) shows the nature and quantities of these metallic ions.

Although the sugar can be recovered chemically from molasses by precipitation methods, these methods are not yet recommended in industry because they need further removal treatments of chemicals unpermissible for human consumption like Ba^{2+} (4).

This process utilizes chromatography as a physical method for the purification of sugar in the molasses. The process utilizes ion-exchange chromatography for separation.

Description of the preparative apparatus

In this research the apparatus used for desugarization of Sudanese molasses was a simple glass column of the dimensions 750 mm x 50.8 mm 0. The column was packed with a cation-exchange resin charged in Ca^{2+} form as shown in Figure (1). A molasses solution of 5% w/v was prepared.

A suitable amount of active carbon was added to decolourize the molasses solution. The solution was then filtered and fed to the top of the column. Afterwards the molasses was followed by an eluent (water). Both penetrated downward through the resin bed under gravity. The resultant solution was collected and then analyzed for the presence and quantities of metallic ions. The theory behind the separation process is that the chromatographic column with an ion-exchange resin acts as an ion exchanger, an ion-exclusion and a gel-permeation to selectively separate metallic ions and colloids from the molasses.

Results and discussions

The analysis of Sudanese molasses before and after elution through the column was performed by Flame Emission Spectophotometry (FES) and Atomic Absorption Spectrophotometry (AAS). FES was used for the determination for K^+, Na^+ and Ca^{2+}, while AAS was used for Mg^{2+}, Fe^{3+}, Hg^{2+} and Pb^{2+}. The result is tabulated in (2). From the figures shown, it is clear that a notable and sometimes complete elimination for monovalent ions like K^+ and for the ions like Ca^{2+} and Mg^{2+} took place. Less deionization resulted in the case of trivalent ions like Fe^{3+}.

The overall performance of the column is adequate for its purpose; however, the scale of the process needs to be modified for commercial application. It was observed that the final product is excessively diluted and that it needs further concentration.

Scaling up of the processing

Figure (2) shows a suggested sketch of a process that is designed to desugarize molasses based on the findings of the column chromatography used in this work. The dimensions of the units of the suggested process depend on the amount of molasses produced by the refinery.

Conclusion

The process proposes to solve a present sugar crisis in the Sudan. The product of the process can serve as a thick sugar syrup in beverages and confectioneries, thus saving the crystalline sugar for other needs.

References

1. FAO Agricultural Services Bulletin (39), pp. 6, 12, 41, 43, 1980.
2. Annual Report "Secretary-General - Arab Sugar Federation".
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TABLE 1

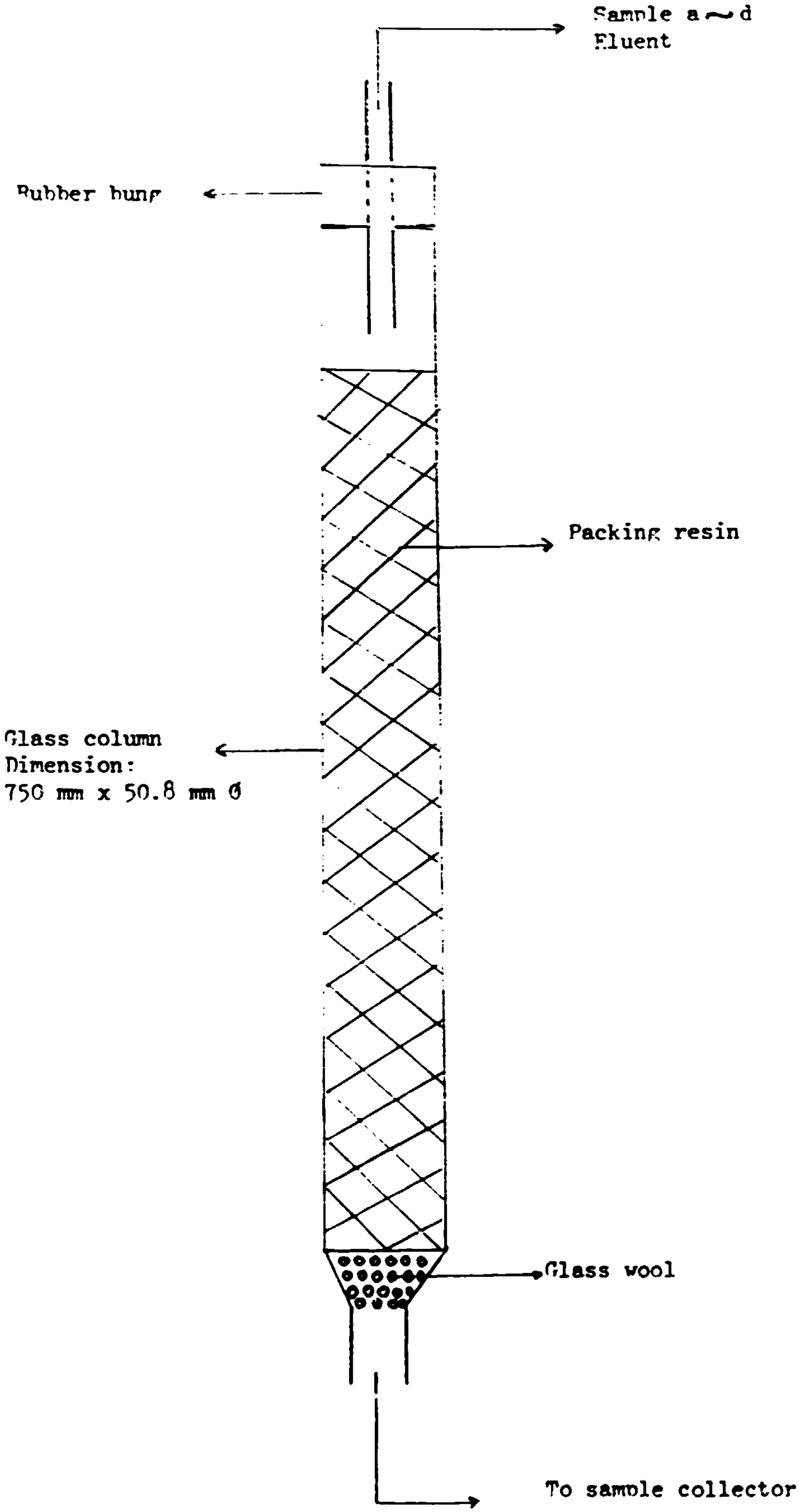
CAN MOLASSES COMPOSITION

Constituent	Per cent
Water	20
Sugar	62
Organic ashes (nitrogenous)	10
Inorganic substances	
SiO_2	0.5
K_2O	3.5
CaO	1.5
MgO	0.1
P_2O_5	0.24
Na_2O	---
Fe_2O_3	---
Silica	1.6
Chlorides	0.4
	100.00

TABLE 2

AMOUNT OF METALLIC IONS IN SUDANESE MOLASSES BEFORE AND AFTER ELUTION

Ions	Amount before elution (PPM)	Amount after elution (PPM)
Na^{+}	708	7.0
K^{+}	550	0.0
Ca^{2+}	495	29.0
Mg^{2+}	445	1.6
Pb^{2+}	2.6	1.4
Hg^{2+}	6.27	5.67
Fe^{2+}/Fe^{3+}	37.0	2.59



<u>Figure 1: CHROMATOGRAPHIC ION-EXCHANGE COLUMN</u>

Figure 2: A BLOCK DIAGRAM OF A SUGGESTED DESUGARIZATION UNIT