EXHAUSTION OF MOLASSES — EQUIPMENT TO DETERMINE TARGET PURITIES

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Abstract

Laboratory equipment for the determination of molasses exhaustion is described. Comparative data are given for this equipment and previously used apparatus.

Introduction

Equipment used for the determination of target purities at the SMRI has been described previously[1, 2] e.g. the laboratory vacuum pan with a capacity of 13 ℓ used in the boiling process which was followed by a series of temperature controlled crystallisers each of 6 ℓ capacity.

For an investigation into the influence of polysaccharides on molasses exhaustion, it had been planned to remove the polysaccharides from final molasses by alcohol precipitation but it soon became apparent that the purification of the necessary quantity of molasses took far too long. For this reason new equipment for the determination of target purities was developed.

Construction of a vacuum pan and crystallisers

For the analysis of reducing sugars, sucrose and ash a sample of about 300 ml is required. The amount of massecuite required for reaching saturation is 500–600 ml. The crystallisers and the graining volume of the vacuum pan do not have to be larger than this volume. However a large amount of material is always lost adhering to the walls of the equipment. In the original apparatus the massecuite was transferred manually from the vacuum pan to the crystallisers. After reaching equilibrium a subsample of massecuite was transferred to a nutsch which separated the crystals from the mother liquor by air pressure. The new equipment was designed in such a way that transfer of material and its inherent loss was reduced considerably.

The vacuum pan was constructed in two parts bolted together (Fig. 1). The bottom part is a jacketed brass cylinder with a capacity of 630 ml and it is heated by passing steam through the jacket. The top part is a Quickfit pipe segment of 80 x 125 mm. The top cover has a vapour pipeline which is connected to a condenser and vacuum pump. To increase the circulation and to measure the mobility of the massecuite, the pan is fitted with a stirrer with a diameter of 40 mm, a speed of 140 rpm, and is placed in a tube to increase efficiency. The top cover is further provided with an inlet tube for molasses and one for the addition of sugar crystals. Massecuite temperature is measured by a thermocouple.

Due to the considerable reduction in size compared with the original vacuum pan it was impossible to apply the same system for torque measurement during the tightening of the molasses under investigation. Torque measurement is carried out by measuring the tension of the chain which drives the

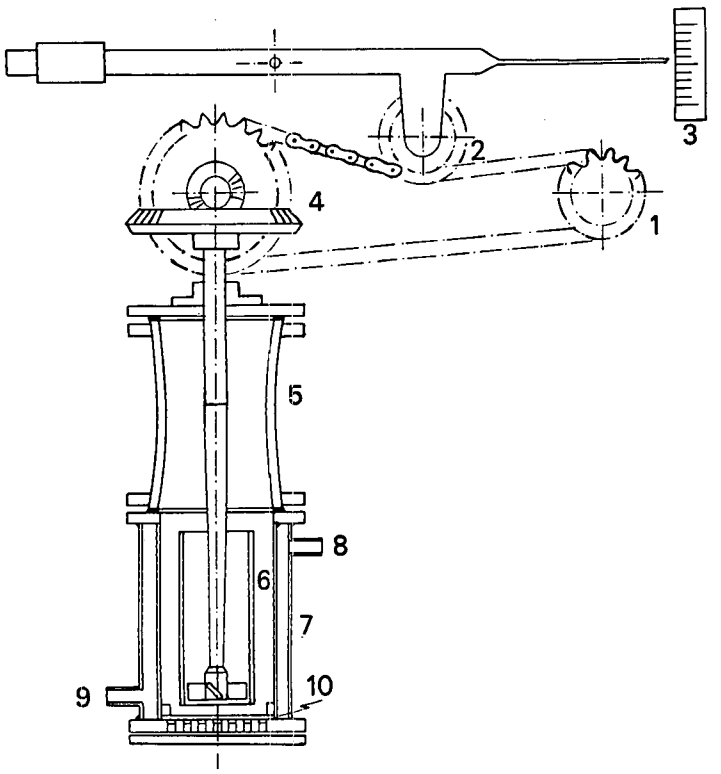

FIGURE 1 Vacuum pan for molasses exhaustion experiments: **1.** Driving sprockets; **2.** Idler for torque measurement; **3.** Pointer and scale for torque measurement; **4.** Sprocket and bevel gears driving the stirrer; **5.** Glass pipe section; **6.** Tube for stirrer; **7.** Jacketed lower part of vacuum pan; **8.** Steam inlet; **9.** Steam outlet; **10.** Screen.

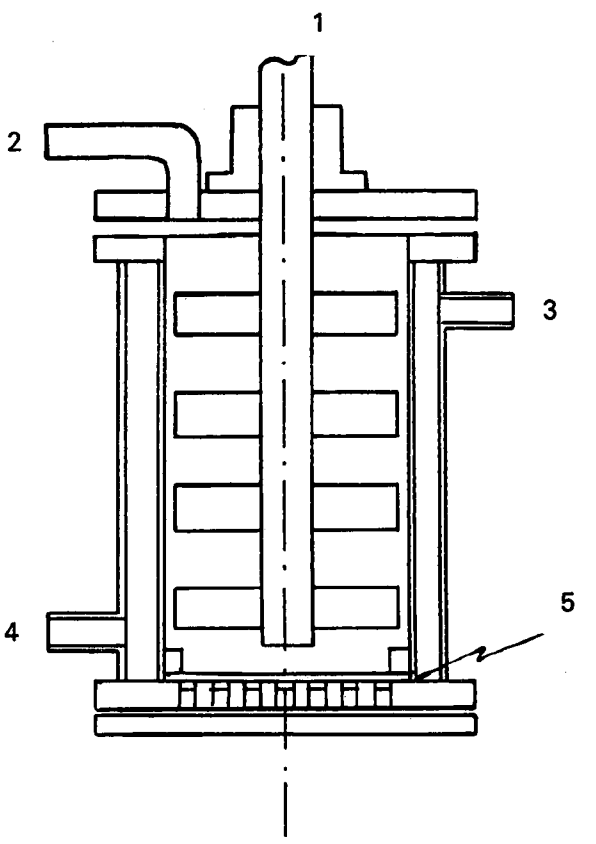

FIGURE 2 Crystalliser for molasses exhaustion experiments: **1.** Stirrer; **2.** Air inlet; **3.** Water outlet; **4.** Water inlet; **5.** Screen.

pan stirrer. As the chain has to be in the vertical plane this stirrer is driven by two bevel gears. The tension is measured by an idler sprocket gear which presses down the chain. The sprocket gear is fitted to an arm with a pointer and scale. As the tension of the driving chain increases the pointer moves up the scale. The correct range can be adjusted by moving a weight along the arm.

After a massecuite of the required mobility has been prepared the bottom part of the pan is disconnected and fitted onto a stirrer assembly, which avoids the transfer of the massecuite from one vessel to another (Fig. 2). As the equilibration of the massecuite in a crystalliser requires a much longer time than the concentration in the vacuum pan there are 4 stirrer units onto which a double wall container can be fitted. The 4 stirrers run at 12 rpm and are driven by one motor. During the equilibration period of the massecuite water of the required temperature is circulated through the jacket of the vessel. As is shown in Figs. 1 and 2 the containers are provided with a perforated bottom covered by a screen which is closed by a solid brass plate. This arrangement avoids the transfer of the massecuite to a nutsch after the mixture of crystal and mother liquor has reached equilibrium. The top cover of the crystalliser assembly containing the stirrers is provided with an inlet for compressed air. After the mixture has reached equilibrium in 48 hours the bottom plate is removed and the mother liquor is separated from the crystal through the bottom screen by compressed air. This mother liquor is subsequently analysed for sucrose and dry solids.

Results

A few molasses samples were exhausted in the old and in the new equipment and their target purities compared. These values are listed below in Table 1.

TABLE 1
Comparison of final purities obtained in the old and new vacuum pan and crystallisers

Sample	New Equipment			Old Equipment		
	Purity obtained	Target pur.	Δ	Purity obtained	Target pur.	Δ
TS	36,9	35,4	0,5	34,1	35,4	−1,3
AK_5	40,0	39,7	0,3	41,1	39,7	1,4
AK_2	38,1	38,7	−0,6	37,8	38,7	−0,9

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REFERENCES

1. J. Bruijn (1964). Laboratory vacuum pans SASTA Proc **38,** 102.
2. J. Bruijn, J. R. Fitzgerald, S. Koenig, A. W. McGillivray (1972). Exhaustion of South African final molasses SASTA Proc **46,** 103.