ASPECTS OF SUCROSE LOSSES: IMPACT ON PROFITABILITY, COMPETITIVENESS AND THE ENVIRONMENT

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Abstract

The two aspects of major importance to factory management in controlling the extent of sucrose losses from process are financial and environmental considerations. The monetary value of the losses of sucrose is very influential through the direct impact on profitability. As well, the environmental impact of sucrose losses is extremely important to ensure sustainability of cane production and processing.

Introduction

The world in which we live and operate sugar production plants is changing at an ever increasing pace. While the predominant focus of sugar millers is to manage the production of sugar within a rapidly changing economic and technical environment, the changing technologies and financial circumstances also direct attention to the management of the sucrose losses from factories. What is acceptable and appropriate today in managing losses is unlikely to be applicable in five or ten years time. Economic and environmental issues impose the need for ongoing changes to the management of losses from factories.

Defining process losses

Process losses are defined differently by different people, depending on the circumstances in which their sugar factories are operating. Within a conventional sugar factory (whatever that is), most production staff would define process losses as sucrose losses in bagasse exiting the final extraction unit (mill or diffuser dewatering mill), mill mud, final molasses and in the liquid effluent. Where molasses is supplied to a distillery, the sucrose in molasses may not be considered 'to be a loss, depending on the economic arrangements between the sugar mill and the distillery.

To define the magnitude and significance of the losses for the factory e.g. by a sucrose balance on the whole factory, a reliable determination of the sucrose in the cane supply must be provided. This measurement is often extremely difficult to conduct economically and there are numerous procedures being used among the different cane industries and among different mills within those industries. Obviously, accurate records of the tonnage and polarisation of the sugar production must be known as well.

The undetermined loss in the total sucrose balance is a good indicator of the state of the balance. Generally, a factory will have a characteristic 'undetermined' loss value which indicates that the balance at a particular time is consistent with other operating periods and circumstances. Areas where actual losses of sugar may occur, in addition to those accounted for in the main outflow streams, include:

- mechanical spillages/drain losses;
- evaporator/pan entrainment losses;
- chemical losses by inversion;
- microbiological losses;
- destruction of sucrose by heat and alkali degradation during processing.

The environmental responsibilities on any process industry require an increasing focus on the disposal of every stream. Irrespective of the sucrose content in the exiting stream, the stream should be considered as a loss if it impacts adversely on the environment or the public perception of the factory. Perhaps a suitable general definition of a loss is when the disposal of the stream is to the detriment of the factory’s operations. This definition encapsulates financial and environmental aspects.

Sampling and measurement of losses

Good management of losses requires that representative samples of the process streams are obtained and suitable and accurate analyses of the required properties of the 'loss' streams are undertaken. Different analyses may be appropriate on the same waste stream depending on the significance of the loss. For example, if the concern is an economic loss, then the sucrose content and the mass flow of the stream are of primary significance. If an environmental concern is paramount, then BOD or COD or perhaps specific impurity components e.g. hydrocarbon based pollutants, phosphates, caustic soda etc. may be paramount. Sampling and analyses should be selected to best suit good management of the loss.

Sampling of waste streams from sugar factories is generally difficult, at least to obtain a representative sample. Obtaining representative samples of final bagasse and mill mud are both extremely difficult due to their non-uniform, non-fluid properties. Measurement of sucrose content in these streams is also subject to considerable error.

Motivation for controlling losses

The two aspects which motivate management to regulate the extent of process losses are financial and environmental considerations. These are discussed below.

1. Financial considerations

The monetary value of losses of sucrose is an influential consideration. How significant economically a loss of sucrose is in a ‘waste’ stream for a sugar factory depends on many factors. Some of these are discussed:

(i) The price of product sugar relative to the value of the waste stream. For example, one tonne of sucrose lost in final molasses has the approximate value of molasses price per tonne/0.78 (where 0.78 is the fractional solids concentration of the final molasses stream). The value of sucrose as product sugar or in final molasses could differ by a factor of 10 to 20. Thus the incentive for minimising the loss depends on the relative prices of sugar and molasses.

(ii) The distribution of revenues between the miller and grower. For example, where the miller receives all the proceeds from the sale of final molasses the impact of sucrose lost in molasses is of much greater concern to the miller than under a scheme where the distribution of revenues from molasses sales is distributed in some negotiated (or regulated) proportion between growers and millers. This latter arrangement diminishes the economic incentive for the miller to undertake processing changes to reduce sucrose losses in the molasses. It also increases the interest of growers in the performance efficiency of the mill. Depending on the political interactions of growers and millers, this latter arrangement can cause substantial distraction for mill management. Similar considerations exist for sucrose losses in final bagasse or mill mud.

(iii) The ownership of cane production, and the ability to expand cane production and sell increased quantities of product sugar influence the relative importance of sugar losses. For example, where a mill owns large cane plantations and there is scope for the economic production of additional cane, then the financial incentives to squeeze the recovery of sucrose from bagasse, mud and molasses must be balanced against the economics of expanding the cane production and processing the additional cane.

(iv) Constraints on the availability of capital to effect processing changes to reduce losses. Limited capital resources may be allocated preferentially to expanding factory throughput, complying with legislative requirements or undertaking a new, more profitable venture.

2. Environmental considerations

There are two elements which affect environmental management of losses, viz.:

(i) compliance with mandatory legislative requirements, and

(ii) conduct of additional measures to ensure responsible, sustainable, environmental management.

It is becoming increasingly important for processing industries and, especially, agriculturally based ones like sugar production, to take a long ranging view on management of the environment of the agricultural and milling operations, to ensure sustainability of cane production and processing. It is important that the industry as a whole takes the initiative to reduce the impact on the environment and not to implement only those measures that are required to achieve legislative compliance.

Conclusions

The management of sucrose losses in sugar manufacture is becoming increasingly important from both economic and environmental considerations. Changing technologies and increased environmental concerns for sustainable production will ensure that increased attention is given to the management of losses from factories.