

## EVALUATION OF RAW SUGAR QUALITY FROM REFINER'S POINT OF VIEW

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For ease in refining and low cost of production, high grade raw sugar is required. Factors of prime importance from refiner's point of view for quality assessment of raw sugar are moisture, ash, reducing sugar, sucrose and starch contents. In addition polarization, colour and grain size constitute important criteria. Raw sugar samples obtained from four sugar mills in Punjab were found to be of desired quality as far as polarization and sucrose were concerned except for one that had lower sucrose. All samples exceeded the prescribed limits for moisture, ash and starch contents. Except for the sample of one sugar mill, rest had higher reducing sugar.

### INTRODUCTION

Raw sugar is the product of sugar factories processing either cane or beet, but predominantly cane and which is purchased by sugar refiner for conversion into refined sugar. In a sugar refinery, the quality of raw sugar is evaluated besides polarization on a number of other parameters. Price structure is determined by scarcity and fluctuation in demand whereas the quality component relates to the processing difficulties and cost of converting the raw sugar involves essentially the removal of molasses from the surface of raw sugar crystals, followed by melting, decolourizing and recrystallization of raw sugar to a desired refined form.

The need to judge refining quality of raw sugar produced by different sugar mills in Punjab led to this study. In past no remarkable work was done on quality assessment in Pakistan.

### MATERIALS AND METHODS

The raw sugar samples R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, and R<sub>4</sub> were collected randomly from the four sugar mills in the Punjab, during session, 1981-82.

The analytical work was carried out in the Laboratories of Crescent Sugar Mills and Distillery Limited, Municipal Corporation and Food Technology Department, University of Agriculture, Faisalabad.

Raw sugar samples were analysed to determine their quality. The following determinations were made :

- 1) Moisture/safety factor
- 2) Polarization
- 3) Ash
- 4) Colour
- 5) Reducing sugar
- 6) Grain size
- 7) Sucrose
- 8) Starch content

Moisture, ash, sucrose and starch contents were determined as described by Plew's in "Analytical Methods used in Sugar Refining" (1970) while polarization, colour, reducing sugar and grain size were determined as described by Pakistan Society of Sugar Technologists in "Uniform Methods of Chemical Control for Pakistan Cane Sugar Factories (1977).

## RESULTS AND DISCUSSION

Refining quality of raw sugar has been known to vary from mill to mill. The results of chemical analysis are presented in Table 1.

Table 1. *Results of chemical analysis of Raw sugar samples*

Determination	Samples			
	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>
Moisture (%)	0.94	0.77	0.86	1.06
Polarization (°)	97.6	98.00	97.4	96.7
Ash (%)	0.73	0.60	0.66	0.76
Colour (ICUMSA Unit)	0.860	0.626	0.347	1.078
Reducing sugar (%)	0.67	0.81	0.76	0.55
Grain size (mm)	1.02	1.01	0.98	1.15
Sucrose (%)	98.4	98.6	98.1	97.6
Starch (ppm)	386	414	482	454

The average moisture contents of samples R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, and R<sub>4</sub> were 0.94, 0.77, 0.86 and 1.06 percent respectively. On Calculation these informations yielded 0.39, 0.38, 0.33 and 0.32 as safety factor values (Table 2). All of these exceeded the recommended safety limits of 0.25 (Baikow, 1967). Tests on polarization values showed 97.6, 98.0, 97.4 and 96.7 degree polarization. The desired polarization values should be 96 to 97 degree (Chen, 1970). From this

angle, the raw sugar of the four mills might be considered as a desired quality. Ash content ranged from 0.60 to 0.76 percent which were appreciably higher than the required 0.40 percent for the high grade raw (Herschdoerfer, 1972). Colour too of the samples exceeded the desired limits i. e., 0.12 units (Gupta and Gupta, 1972). The calculated values for colour were 0.860, 0.626, 0.347 and 1.078 units colour. Reducing sugar contents of R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub> and R<sub>4</sub> were 0.67, 0.81, 0.76 and 0.55 percent respectively. The quality specification for reducing sugar is that these should be in the range of 0.50 to 0.60 percent (Yarmolinskii, 1969 and Herschdoerfer, 1972). Except sample R<sub>4</sub> none of the other met this requirement. The Grain Size observed for the four samples ranged from 0.98 to 1.15 mm (Table 3), thus not complying with requirement of 0.8 mm (Baikow, 1967, and Kelly, 1976). As for as sucrose contents were concerned they were within the prescribed limit of 98.0 percent (Herschdoerfer, 1972) except sample R<sub>4</sub>. Results showed 386, 414, 482 and 454 ppm starch which varied from mill to mill as was stated by Murray *et al.* (1974) and Changes (1985)

Table 2. Safety factor for Raw sugar samples\*

S. No.	Safety factor
R <sub>1</sub>	0.39
R <sub>2</sub>	0.38
R <sub>3</sub>	0.33
R <sub>4</sub>	0.32

$$\text{*Safety factor} = \frac{\text{Moisture}}{100 - \text{Pol.}}$$

Table 3. Grain size of Raw sugar samples

Samples	Sieve aperture in mm.					M.A	C.V.
	1.6	1.4	1.2	0.8	0.4		
R <sub>1</sub>	10.5	7.2	16.5	37.8	18.2	1.02	46.07
R <sub>2</sub>	7.9	5.1	21.1	43.6	15.3	1.01	40.59
R <sub>3</sub>	8.8	4.6	13.1	41.9	21.1	0.98	46.42
R <sub>4</sub>	16.0	3.5	19.2	40.5	15.8	1.15	39.56

M.A. = Mean aperture.

C.V. = Coefficient of variation.

It is seen that raw sugar samples vary widely in their non-sucrose constituents which are highly objectionable in the refinery. Excess moisture is undesirable it effect the stability of sugar while low polarization and sucrose contents are considered as minus points because of less recovery. High ash and reducing sugar yield more molasses. The raw sugar with high grain size have high content of non-sucrose substances and colour matter which creates problems in decolorization process. High starch content too adversely affect refining and one of the causes of syncrystallization, as reported by other research workers.

It is concluded from above discussion that non of them met the requirement of quality raw sugar due to their high non-sugar composition. It is emphasised to manufacture high grade raw sugar for ease in refining and economically better sugar production.

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