

## NOTE

# Syrup Extract Determination

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### ABSTRACT

The recommended ASBC method for determining total extract in syrup gives results that differ consistently from those reported by syrup suppliers. The reason for this discrepancy is that two different methods are used. The ASBC method contains two inaccuracies; one is related to the use of Plato tables, the other to the conversion of a weight/volume percentage to a weight/weight percentage using specific gravity instead of density.

Key words: Carbohydrates, Degree Plato, Specific gravity, Syrup extract

For many years syrup has been used as a basic brewing raw material, and its extract determination is now one of the routine analyses in many brewing laboratories. Unfortunately, the results consistently differ from those reported by the suppliers. The difference amounts to approximately 1% extract, which is of concern when brewhouse material efficiencies are calculated.

The reason for this discrepancy is that two different methods are used. One is recommended by the Corn Refiners Association, the other by the American Society of Brewing Chemists.

### ASBC Sugars and Syrups-5, Extract

In principle, the ASBC method (1) recommends the preparation of a 10% weight/volume (w/v) syrup solution, and the extract is calculated on the basis of the specific gravity and the corresponding degree Plato (2).

### Corn Refiners Association Syrup Dry Substance

The Corn Refiners Association method (3) uses the refractive index of the syrup, and the dry substance is obtained by reference to a specific table. Several tables are available, each of which describes a different syrup. The syrups are grouped according to product, ash content, dextrose equivalent, and type.

A brief review of the ASBC syrup-extract method will help to explain why the analytical results are approximately 1% higher than data provided by the syrup suppliers.

In the ASBC procedure, the use of a table based on pure sucrose solutions is recommended (2). This table relates the specific gravities of sucrose solutions to their weight/weight (w/w) percentages or to degree P.

It is important to recognize that brewing syrup is not a sucrose solution but a mixture of several carbohydrates. An example is shown in Table I.

Table I also lists the densities of 10% w/w solutions and the associated degree P values, which, in turn, should be synonymous with extract. Close inspection of this table, however, shows that the amount of extract in the solutions is only correct in the case of pure sucrose. The other carbohydrate solutions give different results. From this observation, we conclude that the use of Plato tables only approximates the syrup-extract content. Only if the

TABLE I  
Typical Brewing-Syrup Properties

Carbohydrates	Percent Composition	10% (w/w) Solution	
		Density 20/4°C <sup>a</sup>	°P
Glucose	49	1.0375	9.85
Maltose	22	1.0385	10.09
Sucrose	...	1.0381	10.00
Maltotriose	12	...	...
Higher dextrins	17	...	...
Total	100		

<sup>a</sup>From ref. 5.

"combined" densities of the syrup were equal to that of a sucrose solution would the Plato tables produce accurate results.

Another inaccuracy in the ASBC syrup extract analysis arises when a w/v percentage is converted to a w/w percentage.

The following relationship should apply:

$$w/v \% = °P \times D_{4}^{20} \frac{g}{cm^3}$$

$D_{20/4}^C$ , density ratio, states how many times heavier the solution is at 20°C than water at 4°C. Density ratio can be calculated from specific gravity according to the formula published in ref. (2) or can be obtained from the Goldiner/Klemann tables (4).

In the ASBC method the specific gravity 20/20°C is used, resulting in a syrup-extract reading that is erroneously high.

### ACKNOWLEDGMENTS

The authors wish to thank R. Brisson and G. Belleau for their help and valuable discussions.

### LITERATURE CITED

1. American Society of Brewing Chemists, *Methods of Analysis*, 7th ed. Sugar and Syrups-5. The Society: St. Paul, MN, 1976.
2. American Society of Brewing Chemists, *Tables Related to Determination on Wort, Beer, and Brewing Sugars and Syrups*. The Society: St. Paul, MN, 1976.
3. Corn Refiners Association, Inc. *Standard Analytical Methods of the Member Companies of the Corn Industries Research Foundation*. Corn Syrup Analysis E-54. Refractive Index. The Association: Washington, DC, 1980.
4. Goldiner, F., and Klemann, H., eds. *Rohrzucker-, Alkohol-, Stammwurze-, und Korrektionsstafel*. Inst. für Garungsgewerbe: Berlin, 1966, p. 11.
5. West, R. C., and Astle, M. J., eds. *Handbook of Chemistry and Physics*, 60th ed. CRC Press: Boca Raton, FL, 1979-80, pp. D-239, D-244, D-270.

[Received November 15, 1982]