Method 1.7 - Official Methods: mixed juice pol

1. Rationale

Mixed juice samples should be analysed immediately after they are received in the laboratory or, if composited, preserved. This is important especially with mixed juice that has not been heated. Heating under normal processing conditions destroys enzymes and microorganisms, thus reducing the rate of deterioration.

2. Principle

The well-mixed juice is reacted with lead sub-acetate powder for clarification and used to determine the pol of the solution. When calculating the final pol of the sample the Brix of the solution is always needed.

3. Apparatus

3.1 Saccharimeter and 200 mm pol tube
3.2 Stoppered bottle (225 cm^3)
3.3 Stemless funnel (100 mm ϕ)
3.4 Tall form beaker (250 cm^3)
3.5 Watch glass (100 mm ϕ)
3.6 Filter paper, Whatman No. 91 or equivalent (185 mm ϕ)

4. Reagents

4.1 Lead sub-acetate powder

Lead sub-acetate trihydrate [$Pb(OAc)_2 \cdot 3H_2O$], also called basic lead acetate, is poisonous and will accumulate in the human body. Direct contact through the skin, inhalation (powder dust) or swallowing must be avoided. Wear a dust mask, gloves and safety glasses during use.

The lead sub-acetate should conform to the following specifications:

Basic lead (as PbO)	> 33%
Moisture at 105C	< 1.5%
Insoluble in dilute acetic acid	< 0.02%
Insoluble in water	< 1.0%
Chloride (Cl)	< 0.003%
Nitrate and nitrite (NO_3)	< 0.003%
Copper (Cu)	< 0.002%
Substances not precipitated by H_2S (as sulphates)	< 0.30%
Iron	< 0.002%

Refer to Method 11.2 for the determination of the total and basic lead content of lead sub-acetate.

3. Procedure

Take approximately 150 cm^3 of the sample in the bottle provided with a stopper. Add sufficient lead sub-acetate powder for clarification. The amount added should be the minimum for clarification as over-leading will introduce errors. For the first expressed juice, first mill juice, mixed juice, clear juice, limed juice and filtrate, 1.0 g lead sub-acetate per 100 cm^3 sample is usually sufficient.

Shake vigorously to disperse the lead sub-acetate completely and then allow to stand to permit flocculation of the precipitate (usually about 0.5 minute).

Filter through a fluted filter paper held in the funnel which rests directly in the beaker. Cover the funnel with a watch glass to minimize evaporation. Discard the first 25 cm^3 of filtrate.

Using the saccharimeter, obtain the reading on the filtrate.

Measure the Brix of the juice in a refractometer according to Method 1.8.

4. Calculations

The pol % juice is obtained from the saccharimeter reading and the Brix of the juice. The basic formula for the calculation is:

$$\text{pol \% juice} = \frac{\text{normal mass} \times \text{saccharimeter reading}}{\text{mass (g) of 100 cm}^3 \text{ of solution}}$$

where (i) the normal mass = 26.000g when the saccharimeter is fitted with the International Sugar Scale.

(ii) the mass in g of 100cm^3 of solution is equal to 99.718 × apparent specific gravity at 20°C/20°C of the solution. This can be calculated from the Brix.

In practice, the pol is found from Schmitz formula:

$$\text{pol} = \frac{\text{polarimeter reading}}{\left(0.0000576 \times \text{Brix}^2 + 0.014752 \times \text{Brix} + 3.83545\right)}$$

5. Example

Brix % juice	=	10.59°Bx
Saccharimeter reading	=	35.85°Z
Then from Table 3, pol % juice	=	8.96°Z

6. Precision

The tolerance associated with the pol analysis is ± 0.05°Z.

7. References

SASTA (1985). *Laboratory Manual for South African Sugar Factories*. 3rd Edition: 247–248.