

Sulfuric dioxide determination in food

KjelFlex K-360: sulfuric dioxide determination according to the national standard of China

The presented method for sulfuric dioxide (SO₂) determination is based on the chemical degradation of sulfites into volatile SO₂. SO₂ is separated from the sample matrix by steam distillation, with the distillation unit KjelFlex K-360, into a lead acetate solution. The amount of sulfuric dioxide is determined by means of titration with an I₂ 0.005 M standard solution.

1. Introduction

Sulfuric dioxide is an important and universally permitted food preservative extensively used in the processing and preservation of foods. Foods that are commonly preserved using SO₂ or sulfites are fruits and vegetables, fruit juices and concentrates, syrups, wines, jams and to a lesser extent prawns, fish, minced meats, sausages, and mushrooms.

Nevertheless, due to the suspected adverse effects on human health, the residue level of SO₂ is subject to regulatory legislation requiring analytical methods to determine the levels present [1, 2].

Here, a reliable method for the determination of SO₂ in foods employing the automatic distillation unit KjelFlex K-360, according to the national standard of China GB/T5009.34 -2003 is presented.

2. Experimental

Equipment: KjelFlex K-360 (including acid resistant pump) with Metrohm 877 Titrino plus, Mixer B-400.

Samples: Commercial dry cherry tomato and hot pepper powder.

Determination: The samples were homogenized with Mixer B-400. 5 g were weighted into a 500 mL sample tube and the method was verified by using a sodium sulfite stock solution.

Table 1: Method parameters for the distillation and titration with the KjelFlex K-360.

KjelFlex K-360	Metrohm 877 titrino plus		
H ₂ O volume	0 mL	Pause	20 s
NaOH volume	0 mL	Titration solution	I ₂ 0.005 mol/L
Reagent (hydrochloric acid [1:1] or 85 % H ₃ PO ₄)	10 mL	Sensor type	Redox electrode
Reaction time	5 s	Measuring mode	End point
Steam Power	100 %	Titration rate	Optimal
Distillation time	420 s	Stop Criterion	2 mV
Titration Start	420 s	Stop volume	100 mL
Titration type	Boric acid	Stop EP	3
Stirrer speed distillation	7	Stop Time	Off
Stirrer speed titration	10	Filling Rate	max. mL/min

Before starting distillation, 25 mL lead acetate (conc. 20 g/L) solution was added into the receiver vessel and the sulfuric dioxide was released by the reaction of sample

with hydrochloric acid (1:1). Next, the sulfuric dioxide was distilled into the lead acetate solution by steam distillation. After distillation, 10 mL hydrochloric acid 37 % and 1 mL indicator were added to the receiving vessel solution before being titrated with an I₂ 0.005 mol/L standard solution (see Table 1).

3. Results and comparison to BUCHI method

In Table 2, the sodium sulfite recoveries according to the Chinese standard are compared to the recoveries of the BUCHI method [4]. The sulfuric dioxide contents of the samples were determined according to the Chinese standard are listed in Table 3.

Table 2: The recovery results of SO₂ with sodium sulfite (n=4).

Sodium sulfite	Recovery Chinese standard method [%]	Recovery BUCHI method [%]
Sample 1	95.0	96.9
Sample 2	94.1	95.0
Sample 3	95.7	92.8
Sample 4	97.3	98.4
Average recovery [%]	95.5	95.8
RSD [%]	1.2	2.2

Table 3: Determined sulfuric dioxide contents in samples (the result is averaged, n=3; rsd in brackets).

Sample	SO ₂ [g/kg]
Dry cherry tomato	4.59 (2.7 %)
Hot pepper powder	0.0269 (5.6 %)

4. Conclusion

Determination of sulfuric dioxide in dry cherry tomato and paper powder was performed using the KjelFlex K-360. According to Chinese standard of limits on the residual of sulfuric dioxide in different types of food, the content of SO₂ in dry cherry tomato is much higher than the residual of sulfuric dioxide limit [3]. The recovery for the sodium sulfite standard was above 95 % for both the BUCHI application notes and Chinese standard method [4,5]. Following the national standard of China, the KjelFlex K-360 is appropriate instrument for the distillation of SO₂ in foods.

5. References

- [1] AOAC official method 990.28 Sulfites in Foods (1998).
- [2] The National standard of China GB/T 5009.34 – 2003 Determination sulphite in foods.
- [3] The National standard of China GB/T 2760 – 2014 National Food Safety Standard: Standards for Uses of Food Additives.
- [4] BUCHI application note No. 090/2012 Determination of Total SO₂ in Certified Potato Powder Reference.
- [5] BUCHI short note No. 169/2014 Sulfur dioxide determination in shrimps.

For more detailed information and safety considerations please refer to the Application Note No. 216/2015.