

糖和淀粉的TGA

TGA of Sugar and Starch

试样	糖(蔗糖)、玉米淀粉
Sample	Sugar (saccharose), corn starch
应用	生产乳膏的原料
Application	Basic materials for the manufacture of creams
条件	测试仪器: TGA
Conditions	Measuring cell: TGA 坩埚: 70 μ 氧化铝坩埚, 无盖 Pan: Alumina 70 μ l, no lid 试样制备: 分别将5.26mg糖和4.99mg淀粉称入坩埚。如果以10K/min将糖加热, 则会在分解时起泡, 溢出坩埚。加入约20mg干燥氧化铝粉末有助于使试样保持在坩埚中。 Sample preparation: Weigh 5.26 mg sugar and 4.99 mg starch into pans respectively. If sugar is heated at a rate of 10 K/min it foams up during decomposition and may leave the pan. The addition of approximately 20 mg dry alumina powder helps to keep the sample in the pan. 测试: 以10K/min由30 $^{\circ}$ C升温至600 $^{\circ}$ C Measurement: Heating from 30 $^{\circ}$ C to 600 $^{\circ}$ C at 10 K/min 气氛: 氮气, 50 ml/min Atmosphere: Nitrogen, 50 ml/min

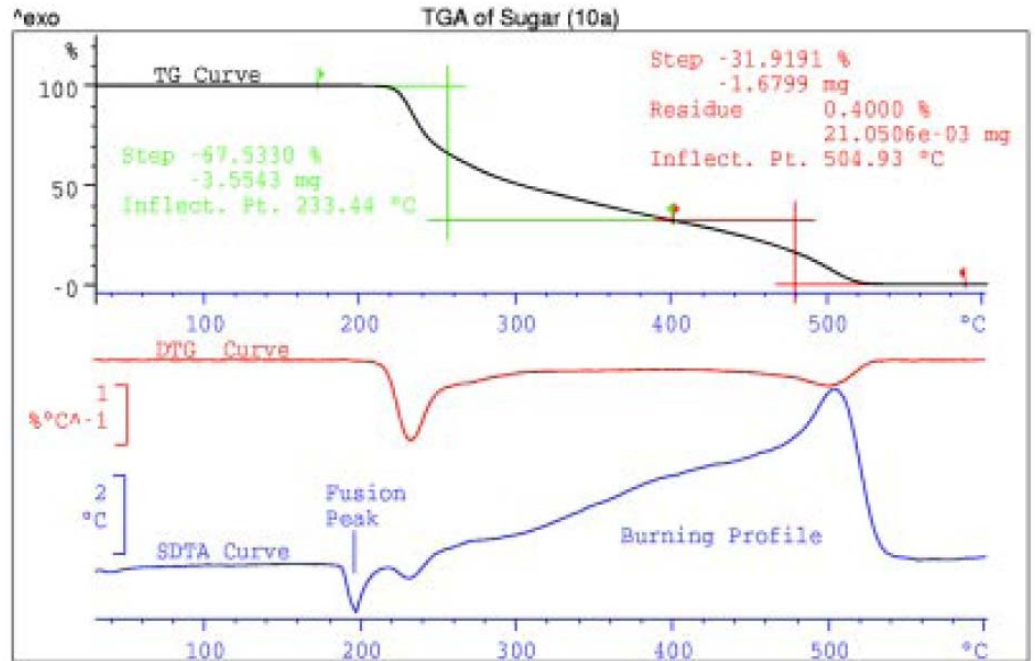


图 4.10 糖的 TGA、DTG 和同步 DTA 曲线

Figure 4.10 TGA, DTG and simultaneous DTA (SDTA) curves of sugar

解释

Interpretation

如图4.10糖的TGA测量曲线所示，高至200°C的TGA曲线平坦部分证明糖中没有水分(<0.1%)。发生的第一个过程是在190°C的熔融，只在同步DTA(SDTA)曲线上可观察到。在液相，碳水化合物失去水并熔化变成焦糖。按化学计量，由分子式 $C_n(H_2O)_n$ 可预计形成60%的水和40%的炭黑。但是，由于发生了其它反应，因而并没有清晰的失水台阶。

As shown by the TGA measurement curve of sugar displayed in figure 4.10, the flat part of the TGA curve up to 200 °C proves that there is no moisture in the sugar (< 0.1%). The first process that occurs is melting at 190 °C, which is only visible in the SDTA curve. In the liquid phase the carbohydrate loses water and caramelizes. Stoichiometrically, from the formula $C_n(H_2O)_n$ one expects the formation of 60% water and 40% carbon black. But, there is no distinct dehydration step because of concurrent other reactions.

计算

Evaluation

DTG 最小值通常用作分开重叠台阶的计算界限。67.3%的失水台阶接近于上述 60% 的值。生成的炭黑放热燃烧至 540°C。SDTA 曲线的形状称为“燃烧曲线”，表示炭黑的反应性。590°C 处 0.04%的残余物为矿物灰分

The DTG minimum is normally used as the evaluation limit to separate overlapping steps. The dehydration step of 67.3% is close to the above mentioned value of

60%. The carbon black formed burns exothermically up to 540 °C. The shape of the SDTA curve is called the 'burning profile' and gives an indication of the reactivity of the carbon black. The residue of 0.40% at 590 °C is the mineral ash content.

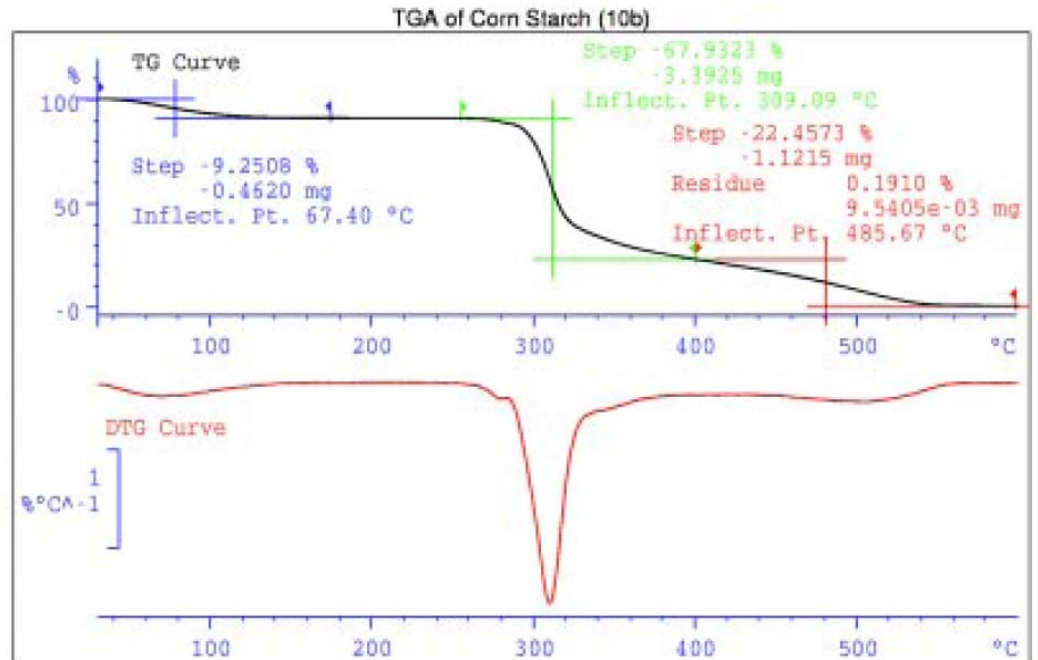


图 4.11 玉米淀粉的 TGA 和 DTG 曲线

Figure 4.11 TGA and DTG curves of corn starch

解释

Interpretation

取决于环境空气的相对湿度，淀粉含有若干百分点的水。如图4.11玉米淀粉的TGA测量曲线所示，失去水分高至200°C。按化学计量，由分子式 $C_n(H_2O)_n$ 可预计形成60%的水和40%的炭黑。同样，由于发生了其它反应，没有清晰的失水台阶。

Starch contains several percent moisture depending on the relative humidity of the surrounding air. As shown by the TGA measurement curve of corn starch displayed in figure 4.11, the moisture is eliminated up to 200 °C. Stoichiometrically from the formula $C_n(H_2O)_n$ one expects 60% water and 40% carbon black. Again, there is no distinct dehydration step because of concurrent other reactions.

计算

Evaluation

DTG 最小值通常用作分开重叠台阶的计算界限。检测到 9.2%的水。接下来 67.3%的台阶高于 60%的预计值。生成的炭黑放热燃烧至 540°C。590°C 处 0.19%的残余物为矿物灰分

The DTG minimum is used as the evaluation limit to separate overlapping steps. There is 9.2% of moisture detected. The next step of 67.9% is higher than the value expected of 60%. The carbon black formed burns up to 540 °C. The residue of 0.19% at 590 °C corresponds to the mineral ash content.

结论

Conclusion

TGA 可测定水分含量、活性成分含量和灰分含量。此外，同步 DTA 曲线上的熔点和 TGA 拐点温度可用于鉴别不同的碳水化合物。

TGA allows the determination of the moisture content, the content of active ingredients and the ash content. In addition, the melting point on the simultaneous DTA curve and the TGA inflection temperatures are used to identify the different carbohydrates.