Application News

SHIMADZU

THERMAL ANALYSIS T107

Measurement of Bread Staling with DSC

Starch grains swell, collapse, and finally become gelatinized when they are heated with water. This process is an endothermic reaction, which is measurable with DSC (See Application News No.85). If left alone, the gelatinized starch grains become hardened as binding and rearrangement of amylopectin existing in starch grains proceed slowly. This is called degradation of starch.
It seems, for example, that there is a profound relationship between this degradation process and the staling of bread with elapse of time after being baked.
The proceedings of degradation of starch was estimated with DSC using bread as an example. When a specimen of staled bread (wheat starch) was heated with DSC, there appeared an endothermic peak resulting from the transition of bound amylopectin. The size of this peak (calorific value) versus the elapse of time after it was baked was plotted.

- Fig.1 through Fig.5 are DSC curves of bread analyzed every day for four successive days just after it was freshly baked. The curves show that the area of transition peak increases as days go by. It is estimated from these data that this transition helps starch recover elasticity again.

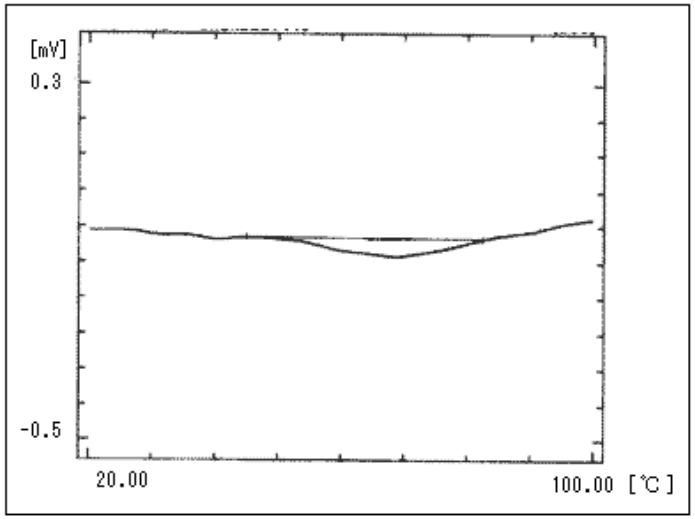

Fig.1 DSC Curve of Freshly Baked Bread

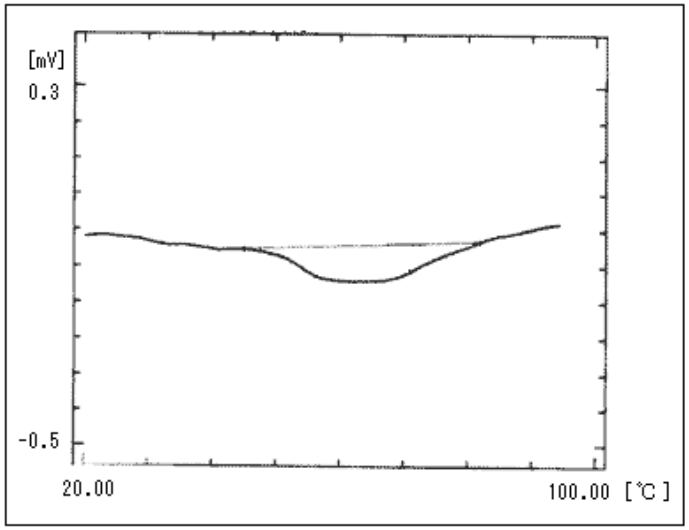

Fig.2 DSC Curve, a day later

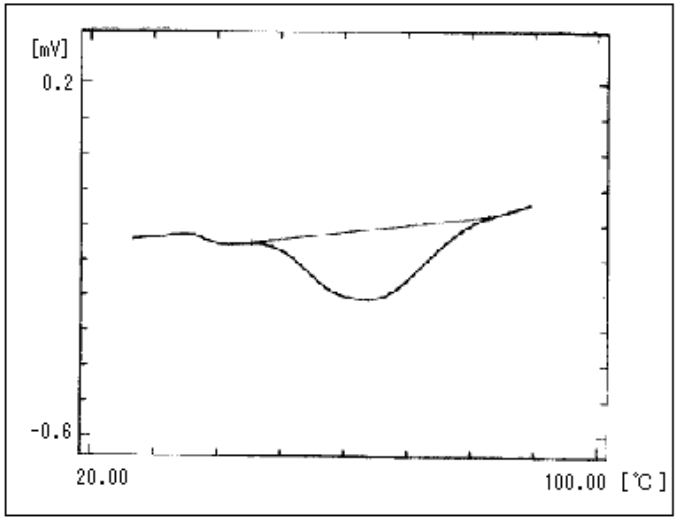

Fig.3 DSC Curve, 2 days later

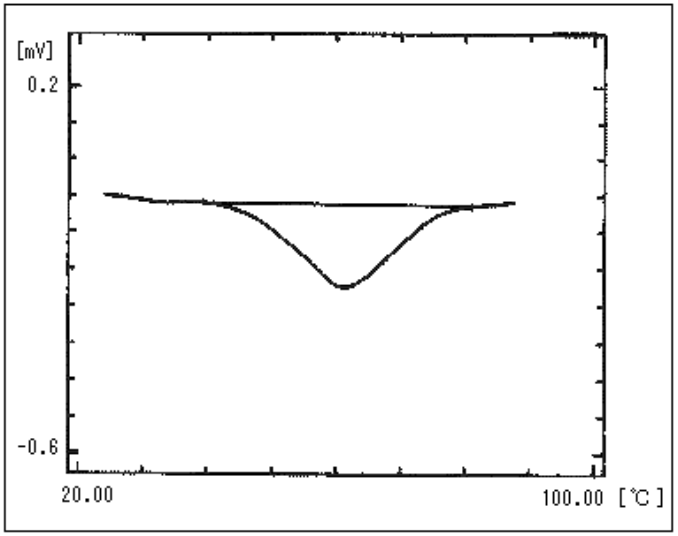

Fig.4 DSC Curve, 3 days later

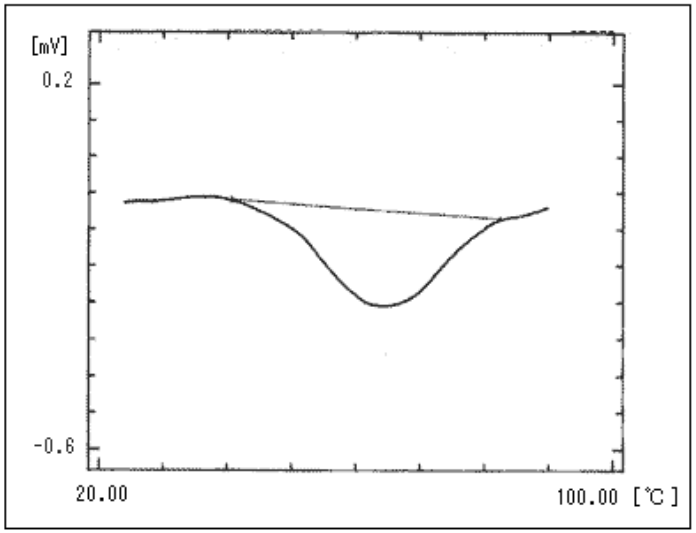

Fig.5 DSC Curve, 4 days later

Analyzing conditions

Specimen : Bread 15mg
Sample cell : Sealed aluminium cell
Heating rate : 10˚C/min.

- Fig.6 is the result of plotting of elapse of days versus transition peak area. It shows the proceeding of degradation process.

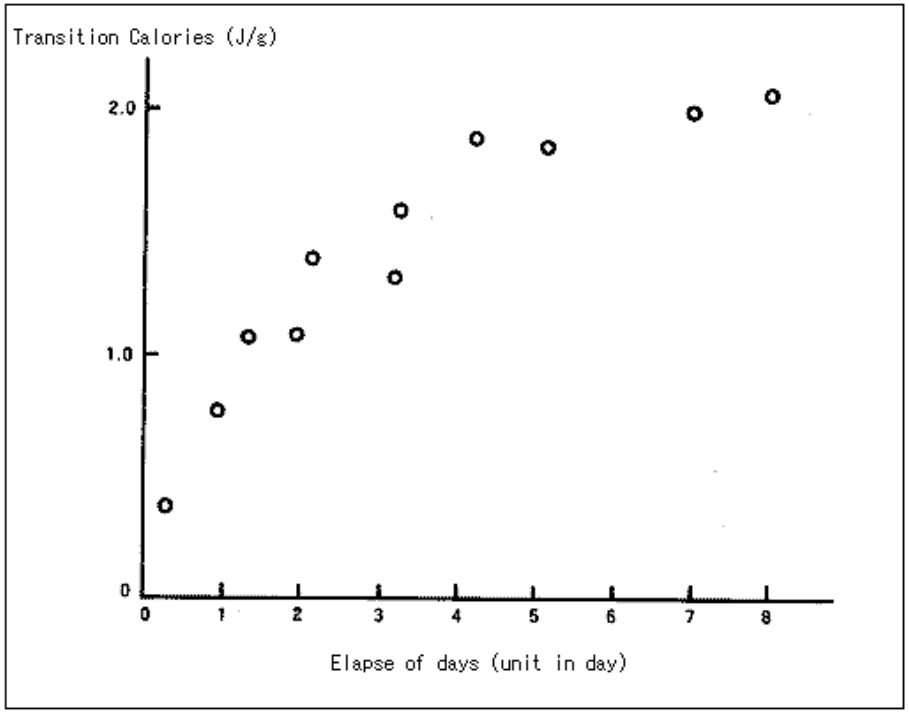

Fig.6 Plotting of Elapse of Days vs. Transition Peak Area

* Please be advised that data obtained before the implementation of the current Weights and Measures Law may be presented in terms of gravimetric unit.

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