Detection of Incipient Granulation in Extracted Honey

by Jonathan W. White, Jr. and Jeanne Maher

Eastern Regional Research Laboratory 1
Philadelphia 18, Pennsylvania

ONE of the more vexing problems in honey processing is the undesired granulation of extracted honey. A great deal of research has been done to eliminate or at least delay this crystallization. The literature on honey abounds with procedures recommended to accomplish this, but it seems proper to say that none is entirely satisfactory. It is not the purpose of this article to review or discuss these methods, but rather to describe a simple device which may be used by the honey producer or packer to detect early granulation in his product so that appropriate treatment may be given.

Honey is supersaturated with respect to one of its sugar components, dextrose. Like all supersaturated solutions, it is therefore unstable and will tend to attain a stable condition. For most honeys (those with relatively low levulose-dextrose ratios) this is reached when a considerable proportion of the dextrose has crystallized as dextrose hydrate. This granulation may be started by several conditions and is certainly hastened by the presence of dextrose hydrate crystals in the honey. These may result from accidental introduction into the honey or by growth from so-called "primary crystals."[2] Other things being equal, a honey which is free from visible dextrose crystals will remain liquid longer than one which has been "seeded." The most common method of eliminating such crystals is by a heat treatment of the honey. In order to provide margins of safety, rather severe heating processes have been recommended for this purpose. The actual amount of heating necessary to destroy dextrose hydrate crystals in honey depends among other factors, on the quantity and size of the crystals; but since there has been no simple means of determining when all crystals have been eliminated, it is possible that considerable overheating may be done, with consequent damage to flavor and color.

In laboratory studies of cystals with the microscope, they are examined with polarized light. Dextrose hydrate crystals are visible under these conditions as bright objects against a black background, which makes them much more easily seen in honey than with ordinary light. This offers a convenient and sensitive means of detecting crystals and has been used in the laboratory by some investigators[2,3] studying crys-

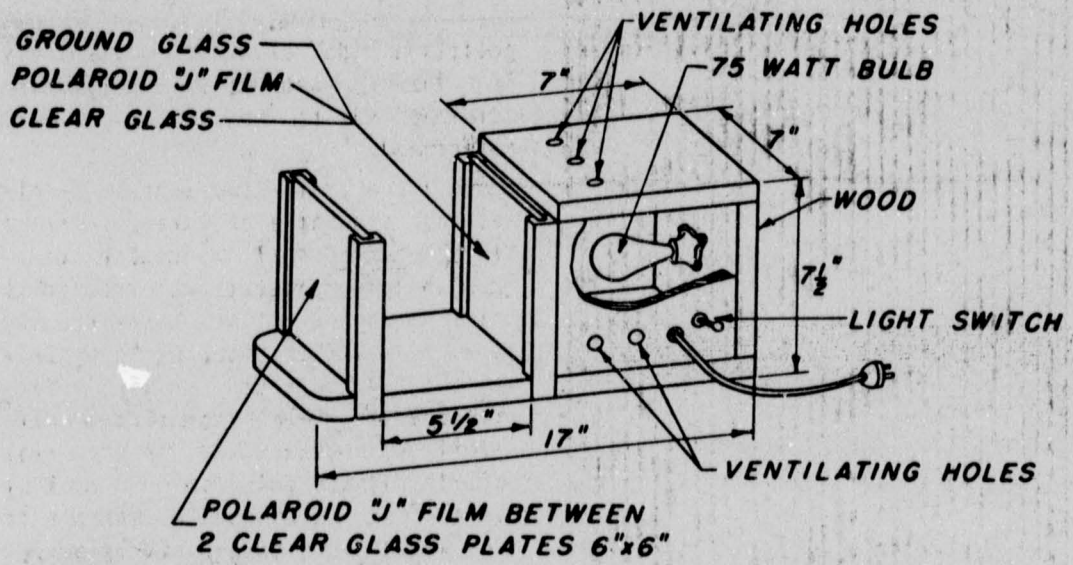

Figure 1: Drawing of Honey Crystal Detection Device, Showing Dimensions.

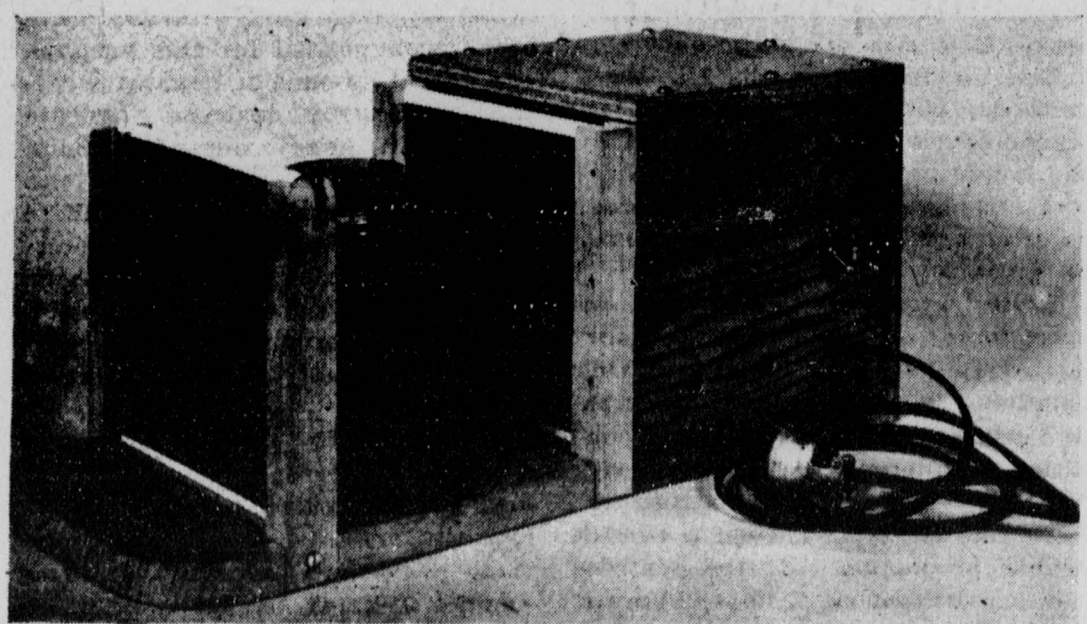

Figure 2: Honey Crystal Detection Device Showing Position of Sample.

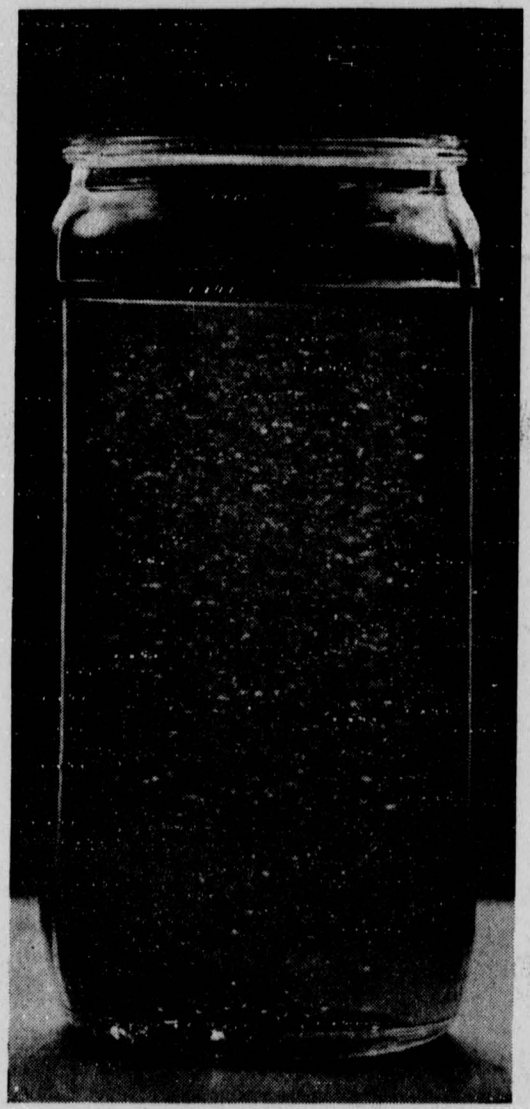

Figure 3: Appearance of Honey Sample When Viewed by Polarized Light. The White Specks are Dextrose Crystals Which Could not be Seen by Ordinary Light.
(U.S.D.A. photos by M. C. Audsley)

tallization in honey. It is obvious that the microscope is not an essential part of such apparatus but that crysals could also be detected using polarizing units and the unaided eye, except that the minimum size of crystal that could be detected is much larger.

Until a few years ago, polarized light was a laboratory tool only. It is now used in many ways outside the laboratory because a simple, inexpensive way to produce polarized light is available.[4] The material sold under the name "Polaroid"[5] is used in a variety of ways to put polarized light to work in the every day world such as in sunglasses, camera filters, and other optical equipment.

We have noted that simply by observing a sample of honey between two pieces of such polarizing material, suitably positioned, extremely small amounts of fine crystals can be detected. For example, to a thoroughly heated and cooled honey, portions of finely-crystallized (so-called Dyce-processed) honey were added. These were t h o r o u g h l y mixed and examined. A sample to which had been added 0.004 per cent of this crystallized honey appeared free of crystals to the naked eye, but the crystals could easily be seen with the polarizing unit. In fact, a single crystal in a jar of honey could be easily detected if large enough to be visible to the eye.

There are many ways that an inexpensive unit could be made for this purpose. The drawing in Figure 1 shows the essentials of such device. All that is required are a light source suitably shaded, and the two light-polarizing units, properly adjusted for minimum light transmission (greatest darkness), all mounted on a frame. Figure 2 illustrates the device in use.

As shown in Figure 1 the Polaroid[6] is sandwiched between a piece of clear glass and a piece of ground or opal glass, which must be on the side nearest the light source. The ground glass serves to diffuse the light. The second Polaroid, sandwiched between two pieces of clear glass, is mounted a convenient distance from the first. The edges of the "sandwich" are bound with adhesive tape. In assembling the glass, care must be taken to avoid excessive dust on the inside surfaces, since it will be visible when the unit

is in use. To reduce possible damage to the Polaroid film it might be advisable to interpose a piece of heat-absorbing glass between the light bulb and the first Polaroid.

For examination, the container of honey is placed between the two sheets of Polaroid and the light turned on. Honey may be in nearly any type of glass container, but must be fairly transparent. If the honey is too dark in color a piece of glass may be dipped in it and examined in the instrument. Honey in retail glass containers may be examined routinely before labelling. Figure 3 shows a sample of honey as viewed in the device. The light spots are crystals. In this particular sample, no crystals could be seen by ordinary visual examination. Other materials in honey are also visible in this device but experience makes it easy to distinguish them from dextrose crystals. The crystals are regular, flat platelets or needlelike objects, while dust particles which may be present are threadlike in appearance. Other materials which may include pollen grains and wax particles appear as tiny points of light, too small for their shape to be discerned.

The absence of crystals visible in this apparatus is of course not a guarantee that the honey will not eventually granulate since microscopically small crystals can bring about crystallization, and other factors enter, but elimination of visible crystals should be of considerable value in this regard. Honey showing crytals when observed by polarized light should be reprocessed to avoid early granulation. It is not claimed that there is anything especially new in this application of polarized light, but in bringing it to the attention of the honey industry it is hoped that it might be of benefit to them.

---

1. One of the laboratories of the Bureau of Agricultural and Industrial Chemistry, Agricultural and Research Administration, U. S. Department of Agriculture.
2. Gubin, A. as quoted in (3).
3. De Boer, H. W.: CRYSTALLIZATION OF HONEY AND THE HEATING OF CRYSTALLIZED HONEY. Chem. Weekblad 28:682-686, 1931; also in The Bee World (London) **13**, No. 2, pp. 14-18 (1932).
4. The Polaroid Corp., 718 Main St., Cambridge, Mass.
5. The use of trade names in no way constitutes endorsement by the U. S. Department of Agriculture of this product over any similar product not named.
6. "Polaroid J-Film Squares, 6" x 6"."

Reprinted from
THE AMERICAN BEE JOURNAL
Volume 91, No. 9, pages 376-377
September 1951