

# Extraction of Cottonseed Oil with Liquid Carbon Dioxide

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**T**HIS paper covers the results of an investigation of the solvent power, for cottonseed oil, of carbon dioxide in liquid form. This process is covered by a German patent, No. 163,057, issued to Albert Sachs, Kopenhagen, 10/29/04.

To determine whether liquid carbon dioxide would extract cottonseed oil, we inserted freshly prepared cottonseed meats into a liquid carbon dioxide bomb cylinder, filled the bomb with liquid dioxide, allowed extraction to proceed for several hours, and then determined the amount of oil dissolved.

The bomb cylinder used for the experiment was a standard steel  $7\frac{1}{2}$  lb. liquid, pressure cylinder. A stub syphon about  $\frac{1}{2}$  inch long was attached to the cylinder valve. The syphon was fitted with a  $\frac{1}{2}$  inch cylindrical screen 4 inches long, and made of 40 mesh bronze wire. This screen permitted the liquid carbon dioxide to be charged to the container, and also allowed the liquid to be discharged from the container when the cylinder was inverted and the valve opened, but prevented the discharge of any meats or meal with the liquid. By a special connection, a high-pressure gauge was attached, after filling, for measuring the pressure of the liquid dioxide. From this pressure, the temperature can be obtained from the dioxide vapor pressure-temperature tables.

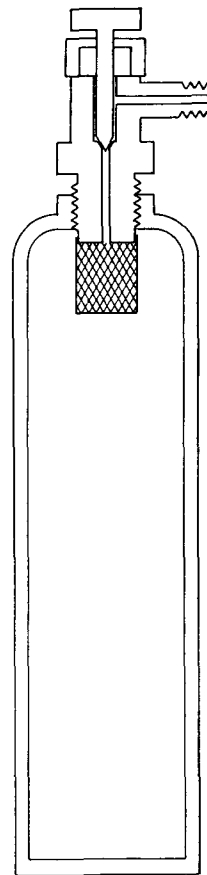
A charge of 450 grams of freshly prepared and rolled cotton-seed meats, or kernels, were placed in the cylinder, the syphon connection was replaced and 7 lbs. of liquid carbon dioxide was charged to the cylinder. After vigorous agitation, the pressure gauge was attached, and the cylinder allowed to stand  $1\frac{1}{2}$  hours, with occasional agitation. During this period, the pressure varied from 855 lbs. to 800 lbs., indicating a temperature of  $71^{\circ}$  to  $69^{\circ}$ F.

The cylinder was then inverted, the valve opened, and the carbon dioxide discharged into a clean container. After completely discharging the cylinder, the container contained no oil whatever, and only about 1 ml. of condensed water. The carbon dioxide, of course, vaporized as it was discharged, even though the cylinder was inverted so as to bring the liquid over the discharge opening of the cylinder. A few small particles of carbon dioxide snow formed occasionally, but even these quickly vaporized.

The cylinder was then recharged with 7 lbs. of liquid carbonic dioxide, agitated as before and allowed to stand one hour, with occasional agitation. This charge made a total of 14 lbs. of carbon dioxide to 1 lb. of meats. The pressure during this second test varied between 675 lbs. and 725 lbs. per square inch, indicating a temperature of  $52^{\circ}$ F. to  $58^{\circ}$ F.

Upon discharge of the cylinder into the container, the results were the same as before, the carbon dioxide was vaporized, no oil was to be seen, and approximately 1 ml. of condensed water was present.

Upon emptying the cylinder, the meats were apparently in the same condition as when charged to the cylinder and the amount of meats recovered was 450 grams. This amount of meats recovered was therefore



CROSS SECTION OF  
BOMB CYLINDER

of equal weight to the meats charged to the extractor.

There was also no fat or oils on the insides of the cylinder, showing that the liquid carbon dioxide had not dissolved any oil. It is true that the liquid carbon dioxide had evaporated very rapidly, but if it had evaporated so fast that it precipitated any dissolved oil contained therein, it would have been found around the neck of the container, and no fat or oil was present anywhere on the insides of the cylinder.

A sample of the meats charged to the cylinder had been retained. Upon analysis, this sample showed 34.60% of oil (by petroleum ether extraction). The meats residue showed 34.57% of oil, or the same as before the experiment, within the limits of experimental error.

Thus by three different methods of test, (1) the lack of change in the weight of the sample of meats used in the experiment, (2) the identical analyses of the meats (within experimental error) before and after the test, (3) the fact that no oil was recovered from the carbon dioxide, we have demonstrated that liquid carbon dioxide has no solvent power for cottonseed oil.