Phenol gives a liquid but the following apparently cause no change: Salol, menthol, thymol, phenacetin, ammonium chloride, phenolphthalein, magnesium sulphate.

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MEDICINAL CHARCOAL.*

BY RALPH L. CALVERT.

The question has been asked, "Is charcoal, when in the moist condition, of any therapeutic value?" This is a question very difficult to answer and impossible to prove by chemical experiments.

Let us first consider the various charcoals and their physical properties. Let us take the two types of wood charcoal, that from soft wood and conversely that from hard wood, and examine a sample of each under the compound microscope. The hard wood charcoal shows a granular structure, while the soft wood exhibits a fibrous structure. No matter how fine the particles of each, the same difference of structure will be apparent. For internal administration we would therefore prefer the soft wood charcoal, not that there is any inherent virtue in soft wood more than there might be in hard wood, but because it is more palatable.

The United States Pharmacopoeia describes charcoal as prepared from soft wood and finely powdered, and states that it should contain not more than 7.5 percent of ash. Samples from various sources have been examined by the writer and found to contain from three to twelve percent of ash. But the ash content really has nothing to do with the medicinal properties of charcoal. The two essential factors are palatability and absorption. The latter term is probably more correctly called adsorption, since it is the disappearance of immense quantities of a gas into small particles of charcoal, caused by the adhesion of the gases to the very extensive internal surfaces which the charcoal possesses.

We can prove by chemical manipulation that dry charcoal will absorb gases to a very high percentage. But charcoal when administered internally becomes moist by the presence of liquids in the stomach and also by the natural secretion of the gastric fluids. Now after admixture of the charcoal with these fluids, will it absorb gases due to fermentation or putrefaction of the stomach contents?

An apparatus was set up as follows:

A cylindrical jar (fitted with a small opening at the bottom to allow admission of air) filled with sodium-calcium hydrate, connected through a thistle tube with stopcock to a flask, which leads through a bulb condenser to a U-tube partly filled with concentrated sulphuric acid, and connected to another U-tube, containing calcium chloride, the latter tube leading to another U-tube, the first half of tube containing calcium chloride and the other half containing copper sulphate on powdered pumice. These series of U-tubes as described were connected to a Midvale absorption tube containing sodium hydrate asbestos, according to the formula by J. B. Stetser. This Midvale tube is fitted with an entrance and exit tube, the latter leading to a U-tube the first half containing calcium chloride and the other half containing sodium-calcium hydrate and connected to a suction pump.

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This apparatus was devised according to the description given by the Association of Official Agricultural Chemists and is used to determine carbon dioxide quantitatively. The purpose of sodium-calcium hydrate, sulphuric acid, calcium chloride and copper sulphate is to hold back carbon dioxide, moisture and sulphides, respectively. The apparatus is allowed to run to obtain a constant and then the Midvale tube weighed. A weighed quantity of anhydrous sodium carbonate is introduced into the flask, and dilute sulphuric acid added through the thistle tube. After effervescence ceases, heat the contents of the flask to boiling.

With the above apparatus experiments were conducted to determine the amount of carbon dioxide taken up by a measured quantity of water. Then a weighed quantity of charcoal was mixed with a measured quantity of water and the same manipulation carried on as above.

In this way by subtracting the result thus obtained from the calculated amount of carbon dioxide liberated we obtain the amount absorbed by the moist charcoal. Less than one percent of carbon dioxide was absorbed by moist charcoal according to the results obtained by a series of tests.

Further investigation proved that charcoal inhibits fermentation. Two hundred mils of a 2% glucose solution were mixed with $^1/_2$ yeast cake, and thirty mils of this added to each of 4 fermentation tubes.

After fermentation had started 0.2, 0.5, and 1.0 Gm. of charcoal were added to three of the tubes, respectively. The fourth tube was used as a blank. At the end of three hours the tube containing 0.2 Gm. of charcoal had a lower reading than the blank, showing that it had slowed the process of fermentation. In the case of the other two tubes, the amount of charcoal added was too great and settled in the neck of the tubes thus preventing a correct reading.

The experiments as above stated would seem to answer the question that "moist charcoal has therapeutic value." Yet we must consider that carbon dioxide alone is not the only gas evidenced in fermentation of the stomach contents. We must also consider that although charcoal inhibits fermentation in a test-tube it may not do the same in the stomach. It has been stated that charcoal prevents the growth of microörganisms by depriving them of their normal amount of moisture. But charcoal administered for that purpose may be saturated with moisture before it reaches its intended field of work. It has also been said that charcoal is a good antidote for phenol, eliminating it through the intestines rather than through the kidneys. This is undoubtedly true with small amounts of phenol but in potent doses it may not be so.

For many years charcoal has been used with supposedly good success, and in summing up the evidence the writer is of the opinion that "moist charcoal is of therapeutic value."

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