a statement should appear in connection with it and the chemically pure anhydrous dextrose, calling attention to their chemical nature and their specific uses.

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## NOTE ON THE TOXICITY OF CASTOR SEED.

BY EDWIN DOWZARD.

The poisonous nature of Castor Seed, which is due to the toxalbumin Ricin, has long been known. A considerable amount of work has been done on the extraction of Ricin, and the determination of its toxicity. The most active preparation has been obtained by Osborne, Mendel & Harris.[1]

Ricin is toxic in the extremely small dose of 0.0005 mg. per kilo when administered to rabbits subcutaneously. When given by the mouth, 4 mg. proved fatal to a medium-sized rabbit. A peculiar property of this very poisonous body is the time required to produce toxic effects. When administered subcutaneously, 0.0005 mg. per kilo did not produce death until after the elapse of seven days, while two days were required for 4 mg. administered by the mouth. Even when given in comparatively large amounts, death did not ensue sooner than fifteen to eighteen hours after administration of the dose.

Ricin is, evidently, a very slowly acting poison.

In all the extraction methods described, the oil-free seed is treated with a 10% salt solution. The active ricin and the inactive globulin are both soluble in 10% salt solution. The non-poisonous globulin which is present in a greater amount than ricin is, however, insoluble in water, while ricin is soluble.

A lengthy process is required to separate the globulin from the ricin. It would be much simpler to extract the oil-free seed with distilled water which would dissolve the ricin but not the inactive globulin.

The writer had occasion to make an investigation in connection with the toxicity of ricin, various extracts of castor seed, and castor seed after the removal of the dark skin. So far as the writer is aware, the toxicity of castor seed, when administered by the mouth, has not been determined. For this reason, it was considered to be of sufficient interest to publish the results obtained.

The raw material consisted of the residue from the cold pressing of castor oil. Heat had not been applied to the seed before, during, or after the pressing process. The material contained 23 per cent. of oil. The average oil content of castor seed is about 50 per cent. The toxicity of the unpressed seed was calculated on this basis. Guinea pigs were used as test animals. The method of administration was as follows:

The seed, after separating the dark skin, was broken into small pieces. A portion was accurately weighed and the pieces gently forced down the throat of the animal by means of a stiff broom fiber. The material was readily swallowed after being forced down the throat for a short distance. It was found possible by the above procedure to administer exact quantities of the seed. There are no

[1] *Amer. Jour. Physiol.*, 14, 259–286, 1905.

noticeable symptoms until a considerable time has elapsed after the administration of the dose. Death is preceded by intermittent convulsions. The following table gives the details of the toxicity determinations:

| Weight of guinea pig, Gm. | Weight of seed containing 23% oil, Gm. | Equivalent weight of unpressed seed, Gm. | Elapsed time between administration of the material and death, hours |
|---|---|---|---|
| No. 1—520 | 0.2 | 0.308 | About 12 |
| No. 2—540 | 0.15 | 0.231 | About 23 |
| No. 3—450 | 0.10 | 0.154 | About 25 |
| No. 4—400 | 0.07 | 0.108 | About 45 |
| No. 5—429 | 0.05 | 0.077 | About 52 |
| No. 6—510 | 0.03 | 0.046 | Did not die |

No. 6 pig was alive and active after several weeks. The toxicity of castor seed is evidently about 0.077 Gm. per 429 grams of guinea pig or 0.179 Gm. per kilo. If the toxicity is in the same proportion about 12.2 grams of castor seed would prove fatal to a man weighing 150 pounds.

RESEARCH LABORATORIES,
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## LABORATORY NOTES.

BY PETER MASUCCI AND MARGARET I. MOFFAT.

### I. THE DIFFUSION OF PHENOL AND TRI-CRESOL THROUGH RUBBER.

A large percentage of bacterial vaccines intended for industrial, hospital, or community practice are marketed in 5, 10 and 20 cc rubber-capped vials. These vials have as a stopper a puncturable rubber cap which permits the removal of the bacterin without exposure to outside contamination. The dimensions of the cap are about $^{7}/_{8}$ inch in diameter and $^{1}/_{16}$ inch in thickness.

Bacterial vaccines as well as most biological products are generally preserved with 0.5% phenol or 0.3% tri-cresol. During the course of a certain investigation it was shown that on determining quantitatively the amount of tri-cresol in certain lots of bacterial vaccines, the amount found was only about one-third of what had been added as shown by the records. We were at a loss to explain the discrepancy. After much speculation, it was decided to do some experimental work in order to determine whether the loss had occurred by the diffusion of the tri-cresol vapor through the rubber cap.*

A review of the literature showed that much work has been done on the penetration of gases through rubber and the factors that influence penetration. Edwards and Pickering[1] have shown that the rate of penetration of a gas through a given sample of rubber is proportional to the partial pressure difference and increases with temperature. Graham[2] advanced the theory that the penetration consisted in the solution of the gas on one side of the rubber, with a subsequent diffusion of the dissolved gas through the rubber and vaporization on the other side. Recently Venable and Fuwa[3] have found that rubber holds a gas in true solution and not by adsorption; that there is a general relationship between the solubility and density of a gas and degree of penetration through rubber.

* This theory was advanced by Mr. S. S. Sadtler, of the S. P. Sadtler Laboratories.