

less than 1 per cent.; in only one-thirtieth was it greater than 2 per cent.; in no case was it as great as 3 per cent.

While it is obviously improbable that an exact quantitative relation should exist, it is believed that from the data here given the calorific power of commercially pure petroleum oils may be predicted from the density with a sufficient approach to accuracy for many practical purposes.

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## SODIUM CHLORIDE, C. P.

BY FRANK O. TAYLOR.

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Ordinarily it is considered a very simple thing to obtain sodium chloride in a state of great purity, and this is perfectly true on a small scale such as would be used in laboratory. When it comes to a manufacturing basis where several hundred pounds would be handled at a time, the problem is altogether different, for containers used in manufacturing operations are of necessity different in material from those which would be used for preparing a very pure product in small quantity.

My attention was directed to this in an attempt to purchase large quantities of exceptionally pure sodium chloride, particularly such as would produce a solution as free as possible from any floating particles, the idea being that this solution was to be used for physiological salt solution, where, in many cases, it would be injected into the body intravenously. Samples of C. P. sodium chloride obtained from a number of chemical manufacturing houses, while in almost all cases free from the usual impurities of sodium chloride such as calcium, magnesium, sulphates, etc., yet invariably showed a very marked trace of insoluble matter when the salt was dissolved in water. Some of this was evidently particles of dust which were present as a mechanical impurity, while other particles bore no resemblance to impurities of this character and seemed to be connected with the chemical character of the salt.

For the purpose of instituting comparison between the different samples of sodium chloride, the residue remaining on strongly heating this insoluble matter was taken as a standard. This, of course, did not show the amount of the organic particles occurring as mechanical impurities, but, as will be seen, these organic particles are not the most important, and the inorganic and nonvolatile portion of the insoluble matter is the best criterion of the purity of the sodium chloride in this respect. For carrying out these tests 50 grams of salt were dissolved in distilled water of exactly the same purity as that described below, the solution filtered through an ashless filter, the filter washed carefully free from chlorides and then incinerated and the ash heated to strong redness in a platinum crucible, after which it was

weighed on a balance turning to 0.05 mg. The following table shows the results obtained, the parts per million referring to the sodium chloride itself and not to the solution:

Sample.	Ash of insoluble matter.
1.....	60.6 parts per million.
2.....	46.0 " "
3.....	30.0 " "
4.....	83.0 " "
5.....	124.0 " "
6.....	27.0 " "

Sample 4 contained a very marked trace of calcium and number 5, while not containing any of the usual impurities of sodium chloride, was still the worst in the amount of ash. Samples 2 and 6 were from the same manufacturer, number 6 being supplied after careful specifications were given as to the quality desired.

It was evident some fault existed in the process of preparation, and it seemed most probable that this was connected with the containers used in making the chemical treatment or in evaporating the solution. To test this theory the experimental manufacture of a few pounds of sodium chloride was carried out. Some of the best grade of commercial salt was treated in the usual manner in earthenware crocks, and the pure solution was evaporated in an enameled steam pan designed for chemical work. Great care was also taken to exclude all dust from the solution during evaporation. The result was very unsatisfactory, the salt making a solution which was full of floating particles having the appearance of silica. On filtering 4 liters of this solution containing 500 grams of sodium chloride, sufficient residue was obtained to prove the presence of antimony and silica.

Finding that the enamel of the evaporating pans was attacked, further attempts were made, using for the evaporation of the pure solution special chemical earthenware made by Duborjal & Company. In two experiments the first contained an insoluble ash of 42 parts per million and the second of 18 parts per million. It being evident that the sodium chloride had some action upon the material of the evaporating pans, experiments were instituted to determine more concerning this action. For this purpose sodium chloride made by Kahlbaum was used. This originally, when examined as above, showed an insoluble ash of 22 parts per million. This sodium chloride was dissolved in pure distilled water which was previously tested and shown to contain 1.2 parts per million insoluble matter, this being a silicate dissolved from the glass containers. The solution was made 16.67 per cent. strength, filtered, and the filtered solution evaporated in containers of various material.

150 cc. of this solution were evaporated to dryness in a tinned copper

dish, an aluminum dish, and a special enamel iron dish made by Doulton & Co. After evaporating to dryness 150 cc. of water were added, the salt entirely dissolved and again evaporated to dryness, after which the salt was once more dissolved in water, filtered through an ashless filter, the filter washed free of sodium chloride, dried, and ignited to obtain the ash.

The ashless filters used were also tested by previously weighing the ash obtained from five filters, and they were shown to contain 0.02 milligram for each filter. The results obtained are expressed in the following table as parts per million:

Insoluble ash.	
Tinned copper.....	209.0 parts per million.
Aluminum.....	36.5 " "
Special enameled iron .	10.0 " "

In order to show that it was the sodium chloride which caused practically all of this action on the evaporating dishes, a quantity of the same distilled water equal to that evaporated from the sodium chloride in the test as above described, was evaporated in the same dishes and then a small amount of water added, the dishes rinsed out with it and any residue in these rinsings carefully collected on similar ashless filters. The results thus obtained are indicated below, allowance having been made, in each case, for the amount of insoluble matter previously contained in the distilled water used. The calculation of this residue into parts per million is made so as to compare directly with the quantities of residue obtained by using the sodium chloride solution and refers to a fictitious weight of salt identical with that used in the preceding experiments:

Tinned copper.....	24 parts per million.
Aluminum.....	11 " "
Special enameled iron.....	0 " "

It will be seen by comparison of these various results that the solution of the sodium chloride to a very marked extent attacks the tinned copper dish, has considerably less action on the aluminum, but still quite marked, and upon the special enamel it has less action than upon any other material which was tested either in these experiments or in the course of manufacture of a few pounds.

This action of sodium chloride on the various enamels and earthenware containers is especially interesting, in view of the experiments recently carried out by J. Thoulet<sup>1</sup> showing that the amount of salt in sea water is distinctly decreased by filtration through pure quartz sand, and he presumes that there is some form of combination of the silica and the sodium chloride. It is possible that something similar may occur in the case of enameled or earthenware containers.

<sup>1</sup> *Compt. rend.*, 146, 94 (1908).

Whatever may be the exact chemistry of this action, it is at least evident that to obtain a C. P. sodium chloride on a manufacturing scale, that shall be free from all insoluble matter, is practically an impossibility, though the amount of this insoluble matter may be reduced, under the best circumstances, to a negligible quantity.

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### NEW BOOKS.

**The Chemical Basis of Pharmacology. An Introduction to Pharmacodynamics Based on the Study of the Carbon Compounds.** By FRANCIS FRANCIS AND J. M. FORTESCUE-BRICKDALE. London: Edward Arnold. 1908. Price, \$4.00.

It is stated to be the purpose of the writers of this book to give their readers an outline of the relationship that exists between the chemical structure and the physiological action of drugs. The arrangement of the subject matter, according to the preface, "is on lines resembling those found in works on organic chemistry, and so much of general chemical theory has been introduced as will suffice to render this portion of the subject clear to those who have not recently studied it."

An idea of the scope of the book is best obtained by a glance at the table of contents. Following a chemical introduction and a general physiological introduction we have a chapter on the aliphatic and aromatic hydrocarbons in which is also treated the physiological reactivity of these bodies as influenced by the introduction of methyl and ethyl groups and also the influence of the unsaturated condition of the molecules and isomeric and stereoisomeric relationships. Then follow chapters treating of changes in organic substances produced by metabolic processes, also of anaesthetics, hypnotics, antiseptics of various kinds, antipyretics, urethanes, ureides, purine compounds, alkaloids, glucosides and synthetic products whose physiological action is similar to that of certain alkaloids. The last chapter discusses taste and odor as dependent on chemical constitution and closes with a brief account of organic dyes. An appendix containing notes on recent investigations and a fairly good index close the volume.

It seems to the reviewer that it is of questionable value to write in our day a hybrid treatise of this sort. It is true that the aspect of pharmacology which is here discussed involves a thorough knowledge of organic chemistry on the part of the author who undertakes to treat it, as witness the exhaustive treatise of Sigmund Fraenkel or the smaller work of H. Hildebrandt. But a few pages devoted to the synthesis of aliphatic derivatives, or to "the methods employed in the synthesis of derivatives of aromatic hydrocarbons," or to the chemical characteristics of various groups of drugs, can be of little value to a reader in the way of preparing