# SCIENTIFIC SECTION

## THE MELTING POINT OF SODIUM PHOSPHATE U. S. P.*

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Under "Sodii Phosphas" the U. S. P. has the statement, "When heated to about 40° C., the salt fuses yielding a colorless liquid." This statement leaves the impression that sodium phosphate has a melting point of 40° C. and that when it is heated no change takes place until this temperature is reached. Experience, however, does not bear this out. Sodium phosphate which has never been heated this high nevertheless undergoes caking and manufacturers frequently have complaints from customers because sodium phosphate which has not been heated to its "melting point" has caked. The reason for this lies in the fact that sodium phosphate dodekahydrate is not stable above 36° C.[1] At this temperature it undergoes transformation into a mixture of sodium phosphate heptahydrate and water, which dissolves a large proportion of the heptahydrate. As the temperature is further raised more and more of the heptahydrate goes into solution until at about 47° C. all of the heptahydrate has dissolved. The point 40° C., therefore, is not a true melting point at all but is merely the point at which the mixture of sodium phosphate heptahydrate and its solution in the water set free at 36° C. will flow. At temperatures between 36° and 47° C. a mixture of sodium phosphate heptahydrate and its saturated solution in water exists. When such a mixture is permitted to cool first, sodium phosphate heptahydrate crystallizes from the solution and finally this combines with the water to form a solid cake of sodium phosphate dodekahydrate. This caking will therefore occur whenever the salt is heated to a temperature of about 36° C. or higher and then permitted to cool.

Numerous experiments carried out in these laboratories have confirmed these facts. Packages of sodium phosphate U. S. P. were placed in an oven held at 102° to 105° F. In four and one-half hours all the packages had risen to a temperature of 94° to 95.5° F. After twenty-one hours in the oven the temperature was still the same. Only after forty-eight hours of continuous heating had the temperature of any of the packages risen above 95.5° F.

In another experiment a glass tube $1^3/_4''$ long by $^3/_4''$ in diameter was completely filled with sodium phosphate U. S. P. and closed with a rubber stopper through which passed a thermometer, the bulb of which was in the middle of the salt. This tube was then heated in a water-bath kept at a temperature 10° higher than the temperature of the sodium phosphate to approximate a uniform rate of heat transfer. At about 85° F. the salt contracted from the sides of the glass tube. At 95° F. a little of the salt liquefied and settled to the bottom of the tube, forming with the suspended crystals a heavy plastic mass. While the thermometer remained at 95° to 96° F. the remainder of the salt gradually settled likewise. At 110° F. there was about $^1/_4''$ of solution above a half-inch layer of still undissolved crystals. Figure 1 shows the time curve of the temperature of the salt. It will be noted that the break in temperature rise occurs at the transition point of 95° to

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[1] Seidell ("Solubilities of Inorganic and Organic Compounds," Second Edition, p. 662 (1919)) gives figures of 35.2° and 36.45° C. for this transition point.

96° F., and that at 104° F. (40° C.) there is no break in the curve as there would have been had there been a melting point at this temperature.

It is therefore obvious that the really significant temperature in this connection is about 36° C. (95° to 96° F.) where the transition from dodekahydrate to heptahydrate takes place. The temperature 40° C. (104° F.) is without significance.

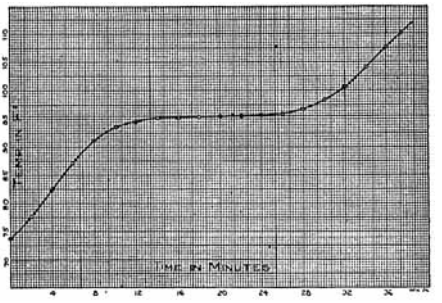


Fig. 1.

It is not possible to prevent caking when sodium phosphate is subject to temperatures of over 35° C. unless sodium phosphate heptahydrate is substituted for the present U. S. P. material. Sodium phosphate heptahydrate is stable up to 48° C. (about 118° F.). This material is stronger than sodium phosphate U. S. P. as it contains 53% anhydrous sodium phosphate as against the present U. S. P. limits of 39.25 to 44%.

SUMMARY.

The "fusing point" of 40° C. given in the U. S. P. is without significance. Sodium phosphate will cake if heated above 35° C. The only way to prevent this is to market sodium phosphate heptahydrate which is stable up to 48° C.

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## STRUCTURAL VARIATIONS IN ERYTHROXYLON LEAVES.

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(*Continued from p. 359, May* JOUR. A. PH. A.)

### HISTOLOGICAL CHARACTERS OF ERYTHROXYLON LEAVES.

As noted in the section dealing with the morphology of several varieties of Erythroxylon, chief attention has been directed to the few species used as sources of cocaine. Comparative data is hardly available except in the form of brief notations in connection with the histological descriptions of the cocaine-yielding species. Necessarily the modifications due to environment must be apparent in histological structure and this part of the study was undertaken in the hope that the data accumulated might be of service in ascertaining the botanical identity of closely related species, or even varieties of the same species. With the constant multiplication of species or new names for slightly varying forms of the same species it is often a problem to decide whether or not the variations are sufficiently extensive to warrant the coining of new specific titles. Still more perplexing is the practice of considering these slight differences as variations and so naming them. Carried to the extreme this would result in each plant being a variety unto itself, for surely each has minor points of difference from others of the same species. While it is admitted that plants of a given genus, or even family, have certain histological characters common to all members, the points of variation in histological structure are, as a rule, just as apparent as the gross differences and perhaps more so. While modification in gross characters is necessarily accompanied by modification of minute structure it is questionable which occurs first.