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If we neglect the terms with  $\frac{d^4x}{dt^4}$  and  $\frac{d^5x}{dt^5}$ , as they are of the order  $\left(\frac{r}{TV}\right)$  with respect to  $\ddot{x}$  and  $\ddot{\ddot{x}}$  and if we notice that integrals like  $\int \rho_0 \frac{xy}{r^5} d\tau'$  are zero, because of the symmetry, these terms of  $\chi_1$  contribute only the following terms for  $f$ :

$$\frac{1}{8\pi V^2} \ddot{\ddot{x}} \frac{\partial^2}{\partial x^2} \int \rho_0 r d\tau' - \frac{1}{24\pi V^3} \ddot{\ddot{\ddot{x}}} \frac{\partial^2}{\partial x^2} \int \rho_0 r^2 d\tau'.$$

Now:

$$\frac{\partial^3}{\partial x^2} \int \rho_0 r d\tau' = \int \rho_0 \frac{\partial^2 r}{\partial x^2} d\tau' = \int \rho_0 \left\{ \frac{1}{r} - \frac{(x-x')^2}{r^3} \right\} d\tau'$$

and

$$\frac{\partial^3}{\partial x^2} \int \rho_0 r^2 d\tau' = \int \rho_0 \frac{\partial^2 r^2}{\partial x^2} d\tau' = 2 \int \rho_0 d\tau' = 2e.$$

The two new parts of  $f$  are together:

$$\frac{1}{8\pi V^2} \ddot{\ddot{x}} \int \rho_0 \left\{ \frac{1}{r} - \frac{(x-x')^2}{r^3} \right\} d\tau' - \frac{e}{12\pi V^3} \ddot{\ddot{\ddot{x}}}.$$

We have to multiply this with  $4\pi V^2 \rho_0 d\tau$ , in order to get the corresponding parts of the force acting on the ion in the direction of the  $x$ -axis, and then to integrate over the whole ion. This gives:

$$\begin{aligned} & \frac{1}{2} \ddot{\ddot{x}} \int \rho_0 d\tau \int \rho_0 \left\{ \frac{1}{r} - \frac{(x-x')^2}{r^3} \right\} d\tau' - \frac{e^2}{3V} \ddot{\ddot{\ddot{x}}} \\ & = \frac{1}{2} \ddot{\ddot{x}} \int \rho_0 d\tau \int \frac{\rho_0}{r} d\tau' - \frac{1}{2} \ddot{\ddot{x}} \int \rho_0 d\tau \int \rho_0 \frac{(x-x')^2}{r^3} d\tau' - \frac{e^2}{3V} \ddot{\ddot{\ddot{x}}} \end{aligned}$$

The value of the second term remains the same when we substitute  $(y-y')^2$  or  $(z-z')^2$  for  $(x-x')^2$ , and is therefore one third of what we should get, if we substituted  $r^2$  for  $(x-x')^2$ . The force which is to be added, becomes then:

$$\frac{1}{3} \ddot{\ddot{x}} \int \rho_0 d\tau \int \frac{\rho_0}{r} d\tau' - \frac{e^2}{3V} \ddot{\ddot{\ddot{x}}} = \frac{4}{3} \pi V^2 \xi \int \rho_0 \omega d\tau - \xi \frac{e^2}{3V}$$

and if this is added to the terms of 111, only  $\frac{2}{3}$  of this last value remains.

**Chemistry.** — „*Plumieride and its identity with Agoniadine*”. by Prof. A. P. N. FRANCHIMONT.

The name Plumieride has been given in 1894 by Dr. BOORSMA of Buitenzorg to a substance which he had isolated from the bark of *Plumiera acutifolia*. Dr. BOORSMA states i. a. that Plumieride does not

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melt, that it is not a glucoside, that its composition is  $C_{30}H_{40}O_{18} + H_2O$  and he concludes that it is a substance quite different from the one prepared in 1870 by Dr. TH. PECKOLT, of Rio de Janeiro, from the bark of *Plumiera lancifolia* and called by him *Agoniadine*. This substance was analysed and investigated in Jena by Prof. A. GEUTHER who gave it the formula  $C_{10}H_{14}O_6$ ; it melted at  $155^\circ$  and yielded on boiling with dilute sulphuric acid a sugar and a brown, amorphous substance and consequently was a glucoside.

In his review of 1895, it is stated by E. MERCK that he had obtained from the root of *Plumiera acutifolia*, a substance different from that of BOORSMA, melting at  $157-158^\circ$  with evolution of gas. He gives as its composition  $C_{57}H_{72}O_{33} + 2 H_2O$  and for its molecular weight 1074—1080, although the given formula requires 1280.

On the occasion of his last visit to Holland, our fellow member Dr. TREUB requested me to re-investigate the plumieride which I agreed to do.

Preliminary experiments made me see at once that plumieride is a polyhydric alcohol, optically active and fairly strong laevogyrate in aqueous solutions; also that it decidedly deserves the name of glucoside and that the sugar obtained in its hydrolysis is birotatory and dextrogyrate and also gives a phenylosazone which is identical with that of glucose, as shown by its melting point and rotatory power. I also noticed that the substance of MERCK behaves in every respect, except in its fusibility, like BOORSMA's plumieride and could show with great probability that the difference is caused by a variation in the amount of water.

When rendered anhydrous, properly purified and crystallised from dry ethylacetate, both appeared to be identical; they do not melt and have the same rotatory power and crystalline form. When recrystallised from water they were again identical, had the same melting point and contained the same amount of water.

Still a difference might have been caused by the fact that BOORSMA had repeatedly boiled his substance with amylalcohol and that it was possible that this is not an inert solvent. I had, therefore, the substance prepared from the bark which had been forwarded to me from Buitenzorg, avoiding the use of amylalcohol and also a high temperature; this preparation after being recrystallised from dry ethylacetate was also identical with the other.

That plumieride yields fairly much glucose on boiling with dilute hydrochloric acid was proved afterwards by isolating the glucose in a pure, crystallised anhydrous state and identifying it by its melting point and rotatory power. At the same time the absence of

mannose and pentoses was shown. Then if plumieride is boiled with hydrochloric acid of 10—12 pCt. strength, only insignificant traces of furfuraldehyde are formed, while the glucose is decomposed into formic and laevulinic acids, which were both identified, in the company of a humus-like substance which is mixed with the second product of the hydrolysis of plumieride, a brown amorphous substance the weight of which amounts in this case to more than half the weight of the plumieride. On boiling with hydrochloric acid of 5 pCt. strength, glucose may be obtained one-fourth part of the weight of the used plumieride although laevulinic acid is also formed here, by destruction of a part of the glucose; the weight of the amorphous substance is then about one-half of that of the plumieride. On boiling with hydrochloric acid of half a pCt. strength, the hydrolysis of plumieride also takes place, although much slower, and a part of the glucose may also be decomposed of which I have convinced myself by actual experiment. The brown substance now certainly weighs less than half the weight of the used plumieride, but still always contains a humus-like decomposition product of glucose. It is, therefore, plain that the exact quantity of glucose which plumieride is capable of yielding cannot, apparently, be determined in this manner and that the second product from the plumieride is not to be got in a pure state in this way.

I hope to communicate later on, at the close of the investigation, about this brown substance and the hydrolysis of plumieride by enzymes.

After plumieride had been undoubtedly characterised as a glucoside, it was desirable to study *agoniadinine* which is also known as such and also gives a brown amorphous substance on hydrolysis, and to explain the difference between both substances, should a difference exist. The difference in melting point goes for nothing.

As bark from *Plumiera lancifolia* was not obtainable, I have made use of about 5 grams of *agoniadinine* sent by Dr. PECKOLT. This preparation, which was not pure, gave after being repeatedly crystallised from dry ethylacetate a beautifully crystallised substance perfectly resembling anhydrous plumieride in shape as well as in chemical and physical properties. It was not fusible without decomposition and had the same laevorotatory power etc. Our fellow member Prof. BEHRENS had the kindness to compare microscopically different preparations of plumieride with each other and with those obtained from PECKOLT's *agoniadinine*; on account of the fact that they have the same form, polarisation and index of refraction, he thinks he may safely conclude that they are identical. I, then, do not hesitate

to declare that the substance, isolated from PECKOLT's agoniadine, is identical with plumieride.

Although it is customary in such cases to retain the name given by the first discoverer, it seems to me that the name „plumieride” is preferable. It reminds of both plants from which it is obtained and by its termination it is more suited for a glucoside. I, therefore, obliterate the name „agoniadine”, which on account of its termination reminds more of an alkaloïd, from the chemical literature and in future will call *plumieride* the substance discovered by PECKOLT in 1870 in the bark of *Plumiera lancifolia*, which substance has afterwards been found by BOORSMA and also by MERCK in the bark of *Plumiera acutifolia*.

Plumieride is a methyl-ester (a methoxyl containing substance) then, it yields methyl iodide with hydroiodic acid of a certain concentration. It yields, by the action of dilute alkalis or barytawater at the ordinary temperature, or by water alone at a higher temperature, an acid which I have provisionally called *plumieridic acid*<sup>1)</sup>. This does not contain methoxyl but is a glucoside which on boiling with dilute acids yields a brown amorphous substance and a sugar, the osazone of which has the same melting point as that of glucose.

If plumieride is now simply a methyl-ester of plumieridic acid as nearly everything found as yet seems to bear out, the easy decomposition (saponification) by alkalis and even by water and the consequent difficulty to obtain a pure preparation by recrystallisation from water becomes apparent.

I, finally, wish to add that the solution of PECKOLT's preparation in cold water was of a very brown colour and strongly reduced FEHLING's solution; when first extracted with ethylacetate it left a good deal of a brown amorphous substance behind and it was only by repeated crystallisation from ethylacetate, which operation was attended with great loss, that it was obtained pure. The impure fractions contained glucose.

**Chemistry.** — “*On the crystallised constituent of the essential oil of Kaempferia Galanga L.*” By Dr. P. VAN ROMBURGH.

When the rhizomes of *Kaempferia Galanga L.*, a plant belonging to the family of the Zingiberaceae, which is cultivated on a small scale by the natives in Java for medicinal and culinary use and

<sup>1)</sup> The name plumieric acid has already been given by our deceased fellow member Prof. A. C. OUDEMANS JR. to another acid obtained from the milky juice of *Plumiera acutifolia*.