



On the ripening of fruits and the gelatious bodies of vegetables

M.E. Fremy

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results between x, y, v . This last equation is often more manageable than the original one.

The process is rendered very simple when the given equation can be reduced to depend on two of the form

$$p = \phi(x, y, v) \quad q = \psi(x, y, v).$$

The second method was completed, Mr. De Morgan states, and out of his hands for transmission to the Society, when he discovered that Mouge had communicated it to the Institute, by which body it was never published. But M. Chasles found it among the manuscripts of the Institute, and stated it a few years ago in one of the notes to his *Aperçu Historique . . . des Méthodes en Géométrie*. Its occurrence in the voluminous additions made to a work which itself treats only of geometry, seems to have prevented it from becoming known to any writer on the differential calculus. Certain particular cases appear in the writings of Legendre and Lacroix.

Let the equation be $\phi(x, y, z, p, q, r, s, t) = 0$. Change x into p , y into q , z into $px + qy - z$, p into x , q into y , r into $\frac{t}{rt - s^2}$, s into $\frac{-s}{rt - s^2}$, t into $\frac{r}{rt - s^2}$. If the equation thus resulting can be integrated, let its solution be $Z = \psi(X, Y)$. Then the solution of the original equation can be obtained by eliminating X, Y, Z from

$$Z = \psi(X, Y) \quad x = \frac{dZ}{dX} \quad y = \frac{dZ}{dY} \quad z = xX + yY - Z.$$

In both methods the most effective mode of proceeding is to find what Lagrange calls a *primary solution*, containing two arbitrary constants, and then to use that primary solution.

LXII. Intelligence and Miscellaneous Articles.

ON THE RIPENING OF FRUITS AND THE GELATINOUS BODIES OF VEGETABLES. BY M. E. FREMY.

THE author gives the following summary of the facts detailed in his memoir on the above-named subjects:—

1. There exists in the tissues of vegetables, and principally in the pulps of fruits and of roots, a substance insoluble in water, which he has named *pectose*; its characteristic property is that of being converted into pectin, by the influence of the weakest acids. It differs essentially from cellulose in all its properties.

2. Pectin exists in the juices of ripe fruits; it may be artificially obtained by causing boiling weakly acid liquors to act upon pectose. Pectin ought to be considered as a weak acid; it does not precipitate the neutral acetate of lead, and changes into pectic acid under the influence of soluble bases.

3. Pectin, submitted for some time to the action of boiling water, acquires the property of precipitating neutral acetate of lead, and is converted into a new substance which M. Fremy calls *parapectin*;

it is neutral to test-papers, and occurs in the juices of perfectly ripe fruits.

4. Parapectin is transformed, under the influence of acids, into a substance which the author calls *metapectin*; it has the properties of a weak acid, reddens tincture of litmus, and precipitates chloride of barium; it may be named *metapectinic acid*.

5. The preceding substances form compounds which are soluble in a certain number of acids, and principally with sulphuric and oxalic acids. These compounds are crystallizable, and form gelatinous precipitates with alcohol.

6. There accompanies pectose in vegetable tissues, a peculiar ferment called by M. Fremy *pectase*; this has the property of transforming pectin successively into two gelatinous acids, which are the pectosic and pectic acids; this change occurs without the presence of air or the disengagement of gas, and constitutes the *pectic fermentation*, which may be compared to the *lactic fermentation*. Pectase exists in vegetables in two states, one soluble and the other insoluble.

7. When pectin is submitted to the action of pectase, the acid first formed is a new acid, the *pectosic*; it differs from pectic acid in being completely soluble in boiling water.

8. Pectosic acid is transformed into pectic acid by the prolonged action of pectase; the pectosic and pectic acids are also formed when pectin is added to an alkali either free or carbonated, or under the influence of lime, barytes, or strontia.

9. Pectic acid dissolves in considerable quantity in neutral alkaline salts, and especially in ammoniacal salts, which contain an organic acid; gelatinous double salts with an acid reaction are then formed, which are precipitated in a gelatinous state by alcohol.

10. Pectic acid, kept for several hours in boiling water, completely dissolves, and is transformed into a new acid, the *parapectic acid*.

11. Parapectic acid changes, under the long-continued influence of water, into a powerful acid, the *metapectic acid*.

These two last acids arise under several circumstances, and principally by the reaction of acids, alkalies, or of pectase, pectin and pectic acid; they possess the property of decomposing by ebullition the double tartrate of potash and copper, like glucose.

12. Gelatinous substances exposed to a temperature of 392° Fahr. disengage water and carbonic acid, and are converted into a black pyrogenous acid, which the author calls *pyropectic acid*.

13. Gelatinous substances exhibit all the generic characters of acids, the capacity of saturation and their power augmenting in proportion as they recede from pectose; they appear to be all derived from a ternary molecule $C^8 H^8 O^7$, and differ from each other only as to water.

14. The properties of the gelatinous substances of vegetables afford an explanation of the alterations which a fruit undergoes when submitted to the action of heat, as well as of the formation *vegetable jellies*. Vegetable jellies may be produced—1st, by the conversion of pectin into pectosic and pectic acids under the influence

of pectase; 2ndly, by the combination of pectic acid with the organic acids contained in fruits.

15. The pectose contained in green fruits is successively transformed, during ripening, into pectin, metapectin, and metapectic acids. These changes are determined by the influence of acids and pectase.

It will appear from this summary, in the opinion of the author, that after having ascertained the nature of the principal properties of the substances which constitute the pulp of certain fruits, he was led to observe that the gelatinous substances of vegetables undergo modifications by the influence of reagents entirely comparable to those to which they are subject during vegetation.—*Ann. de Ch. et de Phys.*, Septembre 1848.

ON SULPHOMORPHIDE AND SULPHONARCOTIDE, DERIVATIVES FROM MORPHIA AND NARCOTINA. BY MM. LAURENT AND GERHARDT.

In 1845 M. Arppe described a peculiar substance which he obtained by treating morphia with an excess of sulphuric acid. To this compound he assigned the formula $4(C^{35}H^{40}N^3O^6) + 5SO$, which is not analogous to any organic compound.

On considering the manner in which this compound is obtained, the authors thought that its composition would resemble that of the amides and anilides; and their experiments supported this supposition: they obtained a similar compound with narcotina.

Sulphomorphide.—This substance was prepared according to M. Arppe's process, by heating morphia with a slight excess of sulphuric acid. When recently prepared it is white, but eventually it becomes green, even in closed tubes; this colour is especially deepened by drying the product at 266° to 302° Fahr.; it is permanent, and does not appear to be owing to the action of the air, for the corresponding product, prepared with narcotina, is immediately obtained of a deep green colour.

Sulphomorphide is a fixed body; heated on platina foil it yields a bulky charcoal, which is extremely difficult to burn. By analysis 100 parts yield—

Carbon	.....	63.0
Hydrogen	....	5.8
Sulphur	.....	5.4

These results lead to the formula $C^{34}H^{36}N^2O^8S$, that is to say, to the formula of neutral sulphate of morphia, minus two equivs. of water, $SO^4(H^2, C^{17}H^{10}NO^3) - 2OH^2$; these proportions require

C^{34}	.....	408	.....	64.5
H^{36}	.....	36	.....	5.7
N^2	.....	28		
S	.....	32	.....	5.1
O^8	.....	128		
		632		

It is to be observed, that the quantity of carbon obtained by ana-