# CHEMICAL WITHER.

By

D. I. EVANS

The reason for withering fresh plucked tea leaf before it can be made into black tea is primarily to obtain the leaf in a pliable condition suitable for rolling, so that the leaf takes a nice twist and no loss of juice occurs when pressure is applied in the roller. The loss of turgidity of the shoot depends on the loss of moisture, and the degree of wither is judged in various well-known ways, most of which are really tests of the turgidity of the leaf and stalk. There is some evidence, however, that time is a factor in withering, and experience supports the contention that the best wither is obtained when the requisite loss of moisture is attained in 18-20 hours, although claims are made that fine teas have been produced when the proper physical wither has been attained in a much shorter period. Consideration of time as a factor in the withering process apart from the loss of moisture has led to the belief that some chemical change takes place in the leaf on the tats, and, whether this is true or not, it has been the subject of several investigations in Java and India.

Deuss, who has carried out a considerable amount of work on the problems associated with withering in Java, and whose results unfortunately are little known in Ceylon, was not able to obtain any evidence of chemical changes during the process. He inclines to the opinion that the loss of moisture is the only change which goes on in the leaf on the withering tats. It is pointed out, however, that unless the wither is carried out with great care, chemical transforma-

tions take place to the detriment of the made tea. These changes are initiated by excessive drying, overheating, and damage caused to the leaf during plucking, packing in the baskets, and during the various processes it undergoes before it is spread out on the withering tats.

The Indian investigators contend that a chemical process takes place during the wither, and Mr. P. H. Carpenter informed the members of the various Tea Trade Associations in London that he had discovered a means of detecting the proper degree of chemical wither. He said:—"Today we have a very simple means of getting an approximate idea of what is happening. If the leaf that has been on the "chungs" or withering racks is infused, you will find that the colour of the liquor that you get from the leaf varies a great deal. In one case you will find that it is a light lemon colour, or even greenish, and it varies from that to the colour of Lyle's Golden Syrup. It is when you get the Golden Syrup colour that you know the chemical wither has taken place; any colour less than that means under-withering. If the process is continued further, you get over-chemical withering which gives a dull brown colour. It is usual in the latter case that the leaf also begins to develop colour. In all cases of proper withering, the leaf will remain green."

According to Carpenter, two methods are available for carrying out the test, the one most easily carried out being to infuse twenty undamaged shoots in a taster's pot with boiling water for 15 minutes before decanting the liquor, which should be a pale golden or ochre colour with no greenish tint, if a good chemical wither has been obtained, but will be pale greenish yellow if no chemical wither has taken place (Method A). The alternative method consists in dropping twenty shoots into ¼ pint of boiling water in a small saucepan, and keeping it in ebullition for 15 minutes before separating the liquor, which should be a bright golden, with a very slight reddish brown tinge (Method B).

There is no indication how these tests have been arrived at, and no proof has been submitted that such a colour change is any criterion of a complete chemical wither which is necessary for making good tea. It is, therefore, impossible to judge the value of the test except by trial, and repeated tests carried out in Nuwara Eliya and in other districts in the Island have given no indication of such a colour change, as will be seen from the following descriptions of the leaf used and the colours obtained. Owing to the difficulty of describing a colour in such a way as to indicate its shade and tint, the colours have been matched against Ridgway's Colour Standards, and his nomenclature has been adopted.

## Method A.

| Leaf Infused | Colour of liquor immediately after infusing | Colour of liquor after standing 24 hours. |
|---|---|---|
| Fresh leaf | Pale green-yellow | Pale green-yellow |
| Same leaf withered for 1 day | Pale Cendre-green | Barium yellow. |
| ,, ,, ,, for 2 days | ,, ,, ,, | ,, ,, |
| ,, ,, ,, for 3 days | ,, ,, ,, | Light chalcedony yellow |
| ,, ,, ,, for 2 days at 22°C. | ,, ,, ,, | Barium yellow. |
| Partly withered leaf kept from further drying at 22°C for 3 days. | Pale dull green-yellow | Light chalcedony yellow |

## Method B.

| Leaf Infused | Colour of liquor immediately after infusing. |
|---|---|
| Fresh leaf | Pale greenish yellow to light green-yellow |
| Same leaf after withering for 1 day | Chartreuse-yellow to citron-yellow |
| ,, ,, ,, ,, for 2 days | Pale green to yellow |

A golden syrup colour has never been obtained, the liquors even showing traces of green when obviously over-withered leaf was used for the infusion. The only marked difference between the liquor of fresh and withered leaf is that the liquor obtained from withered leaf tends to turn yellow on cooling. As this change of colour takes about 8-10 hours to develop, it can hardly be used as a test to determine whether the leaf is withered or not. This change of colour is being further investigated. Prolonging the wither produces no further change, so that the test does not give any indication of over-withering.

A golden coloured liquor can be obtained if the withered leaf is damaged in any way before being infused. Careless handling of the withered leaf while selecting shoots for infusion is generally sufficient to start the chemical changes, and if such damaged leaf is allowed to stand 3—4 minutes before adding the boiling water, then coloured liquors will be obtained. It may be contended that this indicates the leaf to be chemically withered, but unfortunately for that argument fresh leaf will also give yellowish brown liquors if crushed, and allowed to stand a few minutes before being infused.

The failure of the test in Nuwara Eliya might be due to some intrinsic property of the leaf, or that such a change is very slow under the cooler climatic conditions prevailing at this altitude, although this

seems to be disproved by the results of the experiments where partly withered leaf was kept for 3 days before being infused. The liquors obtained from this leaf did not differ appreciably from those obtained with fresh leaf.

When the test was tried under estate conditions at lower elevations, it was found that it was almost impossible to select undamaged leaf from the withering racks under factory conditions. One or other of the leaves attached to the shoot has been slightly damaged, or subjected to a greater drying than the rest, so that, on infusing, brownish patches are easily seen on the infused leaf, and the liquors obtained are coloured. It is necessary to draw attention to the necessity of selecting undamaged leaf for the test, for, if this is not strictly adhered to, a coloured liquor only indicates a degree of fermentation of part of the leaf, which should be avoided as far as possible if a bright uniform infusion is aimed at in the made tea.

The leaf used for the experiments was carefully plucked, and spread on the withering racks along with the rest of the day's pluck, so as to undergo the same treatment. When the necessary precautions are taken, tea leaf can be withered without any trace of colour appearing in the leaf, but at no elevation were golden coloured liquors obtained on infusing leaf withered in this careful manner. Leaf taken at random from the tats invariably produced coloured liquors, but, the leaf, however, showed reddish patches on examination.

The results obtained under estate conditions support the conclusion arrived at in the laboratory, that undamaged withered leaf of Ceylon tea does not give yellow coloured liquors when infused, and it is doubtful whether the coloured liquors obtained in India indicate anything but a particular condition of the leaf characteristic of that country. On informing Mr. Carpenter of my experiments, he writes:—"The test, I admit, is a very crude one and it is possible may only be applicable to the fast-growing succulent leaf that we obtain in mid-season, and then only under the high temperature conditions that we have for withering."

The effect of time on the wither can be explained on the hypothesis that the drying effect causes a concentration of the cell sap, so that the degree of dispersion of the cell constituents is altered. The increase in concentration thus affects the physical condition of the colloidal material of the leaf, with consequent changes in the permeability and the surface area which is of so much importance for cell oxidative processes. Since coagulation is affected by time and temperature as well as by changes in concentration, it will be realised that variations in the time taken and the temperature employed to attain the requisite loss of moisture will affect the degree of dispersion of the cell contents. The amount of surface available for oxidation will thus vary according to the manner in which the leaf has been withered, and the nature of the teas made will differ accordingly.