

## Near Infrared Moisture measurement

### Tea process



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MCT 330-BT



MCT 360



log data screen from the Operator Interface



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## Moisture in Tea

Moisture content is an important parameter to monitor at multiple stages in the production of tea: it affects processing, energy consumption and thus production costs, taste and flavour characteristics, shelf-life and the safety of the product for consumption.

Key locations where moisture should be checked:

1. Withering troughs: Under-withering will cause damage to the leaf in the rolling process, this will affect processing downstream resulting in a low grade or useless product, it will also cause issues in CTC processing; the cutting and tearing of too wet a leaf will result in lumps during fermentation. Under-withering can cause non desirable bacterial growth above 25°C. Essentially if the wither moisture is consistent and on target for the type of tea production, the control parameters down stream will not need to be adjusted so often, the dryer load will be less, and the processing costs will be minimised.
2. Fermentation process (black tea): Dhool moisture is measured to check that fermentation has reached the point where it needs to be terminated to ensure flavour characteristics
3. Dryer  
Input: This will enable feed forward control of the dryer, typical input moisture is around 60-70 %  
Exit: Enables feed back control of the dryer, target output moisture is 3.5 +/- 0.5 % for rolled tea, and 2.5 +/- 0.5% for CTC tea.

If the tea is over-dried, it will develop a bakey flavour. Volatiles are driven off which are essential to the flavour characteristics of the tea. Over- drying is wasteful on two further accounts; excessive usage of energy and lower yield.

Conversely, it is important to ensure moisture content doesn't exceed the upper limit for this will affect taste and shelf-life.

4. Pre-packaging  
As a QC check

## Summary of Process

Tea processing differs according to the tea type. Black tea undergoes a fermentation process whereas green tea doesn't. All teas undergo drying and shaping processes.

Tips are typically picked twice a year; a tip includes the terminal bud and 2-3 young leaves, in the production of black tea, these are withered in open or enclosed troughs, 1.8m x 24m. Warm air is pumped in through a bed depth minimum of 7.5cm in the situation where product proceeds to CTC processing, as opposed to a rolling table. Withering takes many hours for the breakdown of complex molecules into simpler molecules which undergo recombination. This in turn, defines qualities such as body and flavour in the made tea. Withering not only changes the chemical properties of the tea, but also the physical; the loss of moisture causes the leaf to become limp and more rubbery in preparation for the CTC (Cut, Tear, Curl) operation. CTC involves the tea being fed through a series of sharp toothed cylindrical rollers which macerates the leaf, releasing sap from within the stem and leaf. The disruption of the leaf/stem causes the tea to oxidise (ferment) imparting the flavour and colour to black tea. Fermentation is stopped after approximately 3 hours by heating to deactivate the enzymes. The tea is finally dried in fluidised bed or conventional steel tray tea dryers prior to blending and/or packaging.

## Measurement location and performance

Any NIR moisture measurement device views the product surface and doesn't penetrate more than 1-2 mm at most, into the product. This means it will provide the most accurate results on homogeneous product, and that which maintains a constant relationship between surface and bulk moisture.

On-line measurement is feasible at the entrance and exit of the final dryer, where continuous measurement enables much better control than the moistures obtained from random samples taken and tested using moisture balances.

An "at-line" measurement can be taken at virtually any stage during the tea making process, and offers the advantage of instantaneous moisture readings compared with the 3-15 minute wait required for the moisture balances typically used. Care needs to be taken to ensure that the samples taken are representative of the bulk, as readings can be obtained so quickly, the taking of multiple samples to obtain a good representative average is not an onerous task.

Product	Moisture range	Typical accuracy
withered leaf	60 – 70 %	+/- 1.0%
fermented dhool	55-60% moisture	+/- 0.7%
exit of final dryer	2 – 4% moisture	+/- 0.2%