

OUR ENCOUNTER WITH CTC PROCESSING IN SRI LANKA

C. Kandappah

*(Research Officer, Technology Division,
Tea Research Institute of Sri Lanka,
Talawakele, Sri Lanka)*

INTRODUCTION

CTC (crushing, tearing, curling) processing of tea was introduced in 1931 in North East India but became popular only after the fifties. Today about 75 % of the production in India is CTC; Kenya produces almost all their teas by the CTC process.

In Sri Lanka, CTC processing was tried out on a limited experimental scale both at St. Coombs, Talawakele and St. Joachim, Ratnapura to explore the possibilities of introducing this method of processing into this country. However at that time it was felt that the Sri Lankan character of teas was lost due to the harsh severe maceration that takes place from the CTC processing and as such the matter was not pursued with any interest. The demand for 'Ceylon Quality Teas' did not warrant the conversion to CTC, until in the eighties a limited production of CTC was carried out mainly in the Matale region in respect of the plainer liquoring teas for which the demand was poor. From the beginning, it was debatable whether the best high grown teas should be converted to CTC teas.

At Hunasgeria, Elkaduwa, CTC manufacture was carried out for over three decades. But a proper CTC was not carried out at the beginning due to a lack of proper know how. Further, there was no particular demand for CTC teas until the 'Tea Bag' became popular in the recent past.

CTC Machine

These machines are available in sizes of 24, 30, 36 and 48 inches. The standard machine consists of a fast and a slow roller working usually at speeds of 700 and 70 revolutions per min respectively. The dimensions of the rollers are as follows:

Roller diameter	-	8.25" to 8.5"
Vertical grooves	-	8TPI/10TPI (tooth per inch)
Depth	-	0.080" (approx.)
No. of Helical grooves	-	50/60 (approx)
Depth	-	0.068"

The high and slow speed rollers are meshed at a gap in the order of approximately 5 thou. The recent models of the CTC machines are designed with several built-in advantages:

- i) The dejamming device
- ii) The micro mesh arrangement to adjust the rollers during the processing
- iii) Identical shafts to the high speed (HS) and slow speed (SS) rollers and thus being able to interchange the positions of the two rollers.

Raw Material

"Flush of a poor standard from the point of view of chemical composition cannot under any conditions of processing be converted to good made tea". This age old fact is not an exception to CTC teas which is another method of black tea processing. All factors that are considered desirable for the production of good black tea by the conventional method are also applicable to the CTC teas. This is confirmed by the evidence that the clonal classification of the CTC teas of the popular clones based on quality was identical to the classification by the conventional manufacture process.

It is therefore logical that a good standard of flush is of prime importance to any type of processing. Refuse tea percentage together with the grade percentages will exactly reveal the standard of flush. A leaf count will definitely give an indication.

Wither

A physical wither of around 28-30% OT. MT/WL (Outturn. Made Tea/Withered Leaf) has been established as the most suitable wither with respect to machine operation, appearance and made tea characteristics. The moisture in the flush serves as lubricant for the CTC rollers and withers over 34-35% was found to be not suitable. Any wither of less than 26-27% was not acceptable, due to the excessive flaky teas produced. The leaf at this wither does not yield to conditioning prior to CTC processing, resulting in unrolled green particles in the finished product.

A chemical wither of 12 - 14 hours was found essential as against 6 - 8 hours for the conventional processing at a physical wither of 43 - 45%. The harsh character in tea liquor observed in CTC teas is the result of inadequate chemical wither.

Cleaning of the withered leaf

Sand, grit, pebbles, etc should be removed from the withered leaf before feeding into the machines. A withered leaf sifter with a No. 4 mesh is used for this purpose. At the discharge end of the withered leaf sifter a 1/2" welded mesh is provided instead of the No. 4 mesh to remove larger particles.

A band or two of permanent magnet fitted onto the conveyor leading to the first CTC machine of the triplex would pick up any bolt, nut or such metal pieces.

The cleaning of foreign matter from the withered leaf prevents contamination of the finished product as well as prevent damage to the cutter segments.

CTC Processing

The parameters that govern the CTC processing are,

- i) Wither of the flush
- ii) Conditioning of the withered leaf
- iii) The gap setting of the CTC rollers
- iv) The sharpening of the CTC rollers, etc.

A 15" Rotorvane working at a shaft speed of around 25 r.p.m. with one reverse pitch vane centrally placed and an iris end plate (4" broad) in the half open position produces the required particle degradation before feeding into the CTC triplex. The leaf should be fed at a constant rate to ensure uniform feed into the CTC machine. The ammeter attached to the Rotorvane would be an useful guide. The degree of maceration in the Rotorvane depends on the wither, standard of flush, the speed of the shaft, the number of reverse pitch vanes, the end plate pressure, etc.

Conditioning of the leaf is essential as otherwise unfermented green leaf particles would be present in the end product.

A 15" Rotorvane (RV) is the most suitable for the conditioning of the leaf before feeding into the CTC rollers. This is to accomplish the continuous processing as against the batch system that will follow if the conventional rollers are used. As an alternative the orthodox rollers may be used in place of the 15" Rotorvane for preconditioning of leaf; but this would result in a batch process which in turn will not give proper control over fermentation.

The conditioned withered flush from the Rotorvane is passed in tandem into the CTC triplex (3 pairs of CTC rollers) and the dhools (fines) taken. The floor diagram would be as follows:

W.L. → 15" RV → CTC I → CTC II → CTC III → DHOOL

Strictly, if the process were to be a continuous system the dryer dhool-intake should match the dhool-output from the CTC triplex. Therefore the correct size of the CTC machines should fulfil this requirement.

From our experience in the Matale region a 15" RV with a 24" triplex was found to be working satisfactorily as a continuous system with a Fluid Bed Dryer with five sections (FBD 5). Thus the output of the CTC was found to be in the region of 32 kg WL/inch/hour.

The quality of CTC teas would depend on the wither, the standard of leaf, the speed of the cutter rollers, the sharpness of the cutters, the gap setting, etc. It is well known that the greatest wastage occurs in the CTC pair used in the first or initial cut and least in the pair used for the final cut. Therefore it is not economical to change all three cutters together. It was observed that after using for a certain length of time, CTC III cutters could be moved to CTC II position and later to the CTC I position. Taking into consideration these differences in the wear and tear of CTC rollers and depending on the position where they are used, i.e. stage I, II or III there are two options relating to the method of changing CTC cutters. The first option would be to instal a newly sharpened set of rollers for the final cut, i.e. stage III and move this pair at predetermined number of hours of usage in the first instance to stage II and thereafter to stage I. It is preferred if the changeover from stage to stage corresponds to 15,000 kg MT per stage. This would mean that each pair would be utilised for the production of 45,000 kg MT. The other option would be to maintain the CTC cutters in the same positions prior to removal for re-sharpening as opposed to shifting from one stage to the other. In this method of changing rollers the pair used for the first cut would have to be replaced early as opposed to a delayed replacement in the pair used for the final cut. As an example the pair used for the first cut could be replaced at 25,000 kg MT, the pair used for the second cut could be replaced at 50,000 kg MT and the pair used for the final cut could be replaced at 100,000 kg MT. On the whole, this would give an average of 50,000 kg MT per pair of CTC rollers.

Therefore corresponding to the first option mentioned above it would be necessary to remove only one set for sharpening from the CTC I and move the other two towards the Rotorvane and provide a new set in the CTC III position. However, this method of change over will be possible only if all three pairs of CTC rollers of the triplex are of the 8 TPI type. If two pairs are of one type (8 TPI) and the other of a different type (10TPI), the second option of changing rollers described above would be more preferable. Sometimes it is possible that a particular set may not have performed at the required capacity due to incorrect meshing or damage due to foreign matter getting into the cutters. In such cases the damaged rollers should be re-sharpened at once before schedule.

In some factories 10 TPI cutters are used in the CTC III position. These cutters are generally used when it would be advantageous from the point of view to increase the smaller grades such as Pedoe dust.

The dimensions of the 8 TPI and 10 TPI segments are as follows:

	Chasing	Milling
8 TPI	0.080"	0.068"
10 TPI	0.070"	0.060"

One main disadvantage in using 10 TPI at the CTC III position is that it does not permit us to move the cutters to the CTC II and CTC I positions, as only the 8 TPI is used in these positions.

A word of caution is necessary in the sharpening of cutters. The CTC cutter segments and cutting tools are expensive. Maximum use of the cutters between sharpenings should therefore be achieved. It is emphasized to cut into the face of the tooth while only touching the back-slope and never to mill the back-slope of the helical grooves. This is mainly to minimise the wastage of useful metal from the cutter segments. The milling tool should be well ground and not leave a pattern in the helical grooves.

While advocating the maximum use of the CTC cutters before each sharpening, at no stage should blunt cutters be used in any position. Excessive build up of temperature of dhool is an indication of blunt cutters. The end product in CTC processing is directly dependent on the sharpness of the cutters. The chasing is a precision job and accuracy in the order of 0.0001" is required for perfect meshing of the roller cutters.

Once the rollers are properly milled and chased there will not be any difficulty in meshing the rollers and obtaining the required gap setting. A streak of indirect light is used below the rollers and adjusted to obtain the correct gap setting, viewing from the top.

It is possible to carry on the adjustment while the machines are working and the required size of dhool obtained. The settings depend on several factors which are enumerated below:

- i) Uniform roller diameter along the length of the rollers.
- ii) Vibration of the CTC machines.
- iii) Bearing without any play.

When rollers are working it should match perfectly but not touch.

The finest cut in the CTC I is in the order of 0.003" and is increased in steps of 0.002" in the other two.

The particle degradation in maceration is dependent on the surface speed of the tooth profile.

A fine gap setting is an absolute requirement for efficient maceration in the CTC rollers. But it must not be overdone to bring in metal to metal abrasion resulting in damage to cutters. Any form of vibration should be avoided and the bearings should be perfect without any play. The mandrels should be checked for any curvature as any metal piece like a bolt getting through the gap of 0.005" could cause it.

The tooth shoulder to the flank ratio is critical with respect to the output, and the appearance of the end product.

Fermentation

Volatile flavour and quality components are produced during fermentation. Low temperature fermentation results in better end product with better infusions.

A continuous fermenting unit with facilities to pass air through the dhool was investigated. The teas were up to expectation, but the machine causes a few mechanical problems. A thickness of 6-8" dhool with periods ranging from 50 min to 120 min was employed depending on weather conditions and market requirements. Often the trade demanded more colour and strength even at the expense of little quality. This was fulfilled by a longer fermentation period of around 110 - 120 min.

Alternatively, Floor fermentation with a thin spread of around 1" over a period of around 120 min was very successful, the end result being similar. But in most factories suitable space for fermentation continues to be a problem.

In the fermenting area conventionally high humidity is maintained to prevent dhools on the top surface drying. Since soft withers are used (30%) the need for humidification was not found to be necessary.

Drying

At the initial stages of CTC production ECP dryers with smaller tray perforations were used. Scrapers were provided in the top circuit trays to clean the dhool particles sticking to the trays. Excessive lump formation enclosing underfired teas was a severe problem. The use of aerator ball breaker before feeding the ECP dryer did not improve the situation as the lumps were formed inside the dryer. The lumps were then immediately separated and refired. There is a conception that CTC teas will not keep well, over a period of time. It was established that the reason was the high moisture content due to the lumps imparting moisture to the dried teas. The problem of lumps and high moisture content was completely eliminated when the FBD was used. It is now accepted that the FBD is an essential requirement for CTC processing.

The output of dryers in relation to CTC manufacture are considerably less due to the high moisture contents of wet CTC dhools. Depending on the degree of wither and the loss in moisture during fermentation, the output of dryers is around 65% of the output obtained from conventional wet dhools with a moisture content of around 55%.

Grading

The grading of CTC teas is very much simpler. Initially the dried dhools are passed through a series of jumbo pickers (Vibro rollers) to clean the fibre. The clean dhool thus obtained is separated to various grades using a vibro screen or chota depending on the size. Meshes of size Nos. 10, 12, 16, 24 and 30 are used. The large particles over 10, if any, is crushed and taken to off grades.

The fraction through 10 and 12 is Pekoe. The equivalent of BOP that is obtained between 12 and 16 is termed BP I and the fraction between 16 and 24 is PF I instead of BOPF and the fraction between 24 and 30 is PD (Pekoe Dust) while that below 30 is Dust.

If the standard of flush is good and the processing carried out as desired it is not necessary to winnow the teas. But in practice, a certain amount of winnowing takes place in our factories.

CONCLUSIONS

CTC tea processing is very much simpler than the Orthodox manufacture. A consistent product should be the aim and it is possible to automate the processing reducing the labour, unlike in Orthodox processing. The processing without a roll breaker in between simplifies the processing in favour of automation.

The very fact that the cuppage is more (being 150 to 200% more depending on the grade) is sufficient reason to encourage CTC teas for the local internal consumption to a great extent while the surplus could be exported.

Since colour and strength mask the actual quality in CTC teas it is not possible to get the seasonal character of Ceylon teas in CTC teas to the same extent as in orthodox teas. It is therefore not considered desirable in the national point of view to convert our best orthodox marks to CTC. Alternatively we would gain by converting the marginal teas which were not selling well as in the mid country which lacks in quality.