Chapter Two

Tea Processing

Sri Lankan tea industry is around 150 years old and a main source of foreign exchange of the island. The tea manufacturing process consists of five main stages,
1. Withering
2. Rolling
3. Fermentation
4. Drying
5. Grading & Packaging

2.1 Withering

Withering is principally a drying process to remove the surface moisture and partially the internal moisture of the freshly harvested green leaves. In addition, withering is done to get the correct physical condition, which will allow the leaves to be rolled without breaking. Also, the withering promotes dissipation of heat generated during continuous respiration (chemical changes). There are two major types of withering, open or natural withering and artificial or trough withering. In the open method, withering is controlled by the thickness of spread, and the length of time of the withering phase.

Trough withering is a widely used withering process. Usually, the green leaves from the tea estates are brought to the factory in the afternoons and are spread thinly on banks of troughs (tats). The troughs are made of metal wire meshes with wooden support on which tea leaves are spread and the air is blown from the bottom so that the air passes through the green leaves. The air is supplied either directly from an air heater or the exhaust from the dryer, which is usually located at ground level whereas troughs are located in an upper floor. Withering is done at 20–30°C depending on the climatic conditions. For best withering, a wet and dry bulb temperature difference of 4°C is maintained. During withering, the moisture content of the green leaves is reduced up to 55% for Orthodox tea.
production. Depending on the weather and the condition of the leaf, withering takes about 12-18 hours. [6]
In withering, more air is blown at the initial stage and on an average the air flow rate is about 15,000-20,000 cubic feet per minute (CFM) depending on the size of the trough. After four to five hours, the flow rate can be reduced to two-thirds of its initial value. To reduce the air flow rate, throttle valves are provided at the fan inlets. Once proper withering is achieved, the air flow is continued to prevent the spoiling of withered leaves. Withering troughs are generally installed in the first floor of the factory. Green leaf is spread over a wire mesh which is fitted on plenum chamber. The trough should be fitted with a suitable fan to deliver the required quantity of air as per the size of the trough. To achieve proper withering the fan has to deliver around 15-20 CFM air for every one square foot of trough area. For artificial withering hot air from the drier room is mixed with outside air and used. Fans are arranged in such a way that they can draw hot air from the drier and cool air from the atmosphere.

The current of air performs a twofold function: Conveying heat to the leaf as well as carrying of water vapour through a bed of green leaves to achieve physical withering. Whenever the hygrometric difference is below 3° C, hot air is mixed in suitable proportion or heat energy is supplied to increase the hygrometric difference with a corresponding rise in the dry bulb temperature of air. But the dry bulb temperature of air after mixing should not exceed a maximum limit beyond which the quality of the withered leaf is not acceptable. At present, almost all the Sri Lankan tea factories practice trough withering. The dimensions of trough in most of the factories vary considerably. The width of the standard (conventional) trough is 6' and its length varies between 60' and 120'. [1]

2.2 Rolling
The chemical compounds of the tea leaves are released to initiate oxidation in the fermentation process. Rolling twists the leaf, and at the same time, breaks the leaf structure (cells) to release the juices (catechins and enzymes) for oxidation.[6] A compressed drum/roller twists the withered leaves on a continuous circular motion. A rolling machine size varies from 150-325 kg of leaf per hour. The roller has minimum
cutting action and more compressed rolling action. The compression of the roller depends on the type of withering. Low pressure rollers are suitable for under-withered leaves and high pressure rollers for over-withered leaves. Normally, light rolling at the initial stage and heavier rolling at the later stage of the rolling operation are done. The duration of rolling varies from 15 to 45 minutes.

2.3 Fermentation
The rolling process is followed by fermentation, which is a biochemical oxidation process where tea flavours are produced. The fermentation is an important process in black tea production. Oxidation takes place in a room where high humidity air at a temperature of 23-29°C is maintained. The fermentation process does not require any energy unless humidifiers are used.

2.4 Drying
The fermented tea particles are dried or fired to arrest the fermentation and also to reduce the moisture to about 3%. Clean and odourless hot air is passed through the fermented tea particles in dryers. The temperature of the hot air varies between 90–160°C depending on the type of dryer. Drying or firing is a thermal energy intensive operation that also consumes electrical energy to drive blowers and dryers.

2.5 Grading and Packaging
Dried tea consists of particles of different sizes, stalks, fibres, leaf portions, etc. The dried tea is sorted into different grades by passing it over mechanically oscillated sieves for grading. In grading, tea particles are sifted into different sizes then classified according to appearance and type. The colour separator recently being used in the grading process could remove stalk particles by tracing the colour electronically. After grading, tea is packed in airtight containers in order to prevent absorption of moisture. Packaging could be either in tea chests (wood based) or tea bags, etc. packaging as per requirement.