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Hot Water Treatment for Mango Export

Turn Potential into Profit



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Pakistan is one of the largest producers of mangoes which are known for their quality, taste and national value globally. Reportedly about 100,000 tons of mangoes are exported from Pakistan annually. However, presence of certain post-harvest diseases and insects such as anthracnose, stem-end rot and fruit fly, export of mango is limited.

Having short shelf life, most of the mango varieties cannot be stored at low temperature (below 13°C) and it becomes very difficult to export this fruit to international markets. Importing countries like China and Iran have become very sensitive regarding quarantine requirements against insect / pests and diseases specially fruit fly. Both of the countries had demanded hot water treated mangoes to eliminate impact of fruit flies. Since long time, scientists have been working on this aspect using different techniques with an objective to meet quarantine requirements.

Formerly, methyl bromide gas was used in fumigation but its use was abandoned due to higher residual effects unsafe for human health and negative effects on fruit quality. So the researchers concentrated on a technology safe for human health and environment with least negative effect on

fruit quality. Use of hot water has been found safe and effective in meeting the quarantine requirements. It may be used in two ways i.e. hot water treatment and vapor heat treatment (water is passed over fruits in the form of heated vapors). Comparatively, hot water treatment is relatively a cost effective method better for developing countries like Pakistan to and accepted worldwide.

Hot Water Treatment: Fruit is immersed in hot water for a specific time and temperature of water is maintained at a specific level. Duration of fruit immersion and water treatment is decided according to the target (disease or insect/pest). For example, hot water treatment trials conducted in different countries have revealed that control of anthracnose needs five minutes dipping in hot water at 52°C. Whereas to kill fruit fly larvae in the pulp, hot water treatment may be applied at 45 - 48°C for 60 – 75 minutes.

In 1984, USA approved this technology for quarantine control of insect/pests and diseases. According to WTO Agreement, any exporting country will have to meet all such post-harvest treatments for quarantine control, imposed by importing country. After USA, several other mango importing countries like China, Iran and Japan demand hot water treated mango to address the issues of quarantine. Thus the spread of, further infestation and infection can be controlled in countries where these do not exist.



Keeping in view the importance of this technology, many exporting countries have developed their hot water treatment protocols for local varieties. These countries include USA, Philippines, Australia, India, Thailand and Haiti etc. Now, Pakistan is also facing quarantine issues for export of mango fruits. For example, protocols signed with Iran and China requires hot water treatment of 45°C for 75 minutes and 48°C for 60 minutes respectively.

In order to export mangoes to high end markets of the World (China, Iran, Japan, Australia, and New Zealand) Pakistan must meet WTO /HACCP / ISO and SPS requirements. Therefore, quarantine of mangoes through physical or chemical treatment is essential. The chemical treatment faces severe restrictions from different countries, therefore, physical methods such as hot water treatment (HWT), vapor heat treatment (VHT) and irradiation are preferred. Among the physical methods of quarantine, HWT is most economical and safe.



The hot water treatment procedure consists of dipping / immersion of freshly harvested mangoes in hot water at 45-55°C for 3 to 75 minute depending on type of disease/insect, variety and fruit size. After dipping / immersion of the mangoes in hot water, mangoes are dried and processed for packing.)



The hot water treatment system comprises of a feeding conveyor, hot water dipping tank, drying system and packing tray. Each component except packing tray is mounted on wheels for ease of transportation. The water tank is made of stainless steel in order to avoid rusting. The water is heated through three gas burners.

The required temperature of the water tank is adjusted in the panel, when the water temperature reaches to the adjusted temperature burners automatically switch off. Eight no thermo couples are fitted in the water dipping tank in order to check the temperature at different sites of the tank. The water is stirred with a powerful two no re circulation pumps. This stirring keeps the water evenly mixed and helps maintain temperature evenly. The size of the tank is big enough to prevent appreciable drop in temperature in the tank while the fruit is dipped. In the drying system mangoes are dried with the help of two no high speed electric fans. After drying the fruits are allowed to drop in the packing tray for packaging.

During the treatment, it is necessary to keep temperature of water at specific level. As fruit peel may be injured due to direct contact with hot water, so it is also important to regularly monitor fruit pulp temperature.

The following points must also be kept in mind during the use of hot water treatment technology:

- i. During harvesting, fruit should be mature because immature fruits are more susceptible to the development of skin injuries after hot water treatment.
- ii. During handling and transit, treated fruits should be protected from physical injury because such injuries become more prominent on hot water treated fruits.
- iii. If mango fruits have been taken from storage, it is better to keep them for some time at ambient condition before applying hot water treatment until and unless fruit temperature reaches room temperature ($24\pm 1^{\circ}\text{C}$). After treatment, again fruit should be kept at ambient condition to lower down fruit temperature to room temperature, after which they can be pre-cooled for further storage and transportation to target importing country by air or through sea.

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