



Problem Overview

Rambutan is a tropical fruit grown in Central America and Southeast Asia. Current cleaning practices consist of only hand washing methods which impede growth of this industry. The difficulty in removing scale-bugs, mealy bugs and debris from the fruit makes the cleaning process very time-consuming.



Rambutan fruit



Current Washing Process



Scale bug

Mealy bugs

Target Audience

- Rambutan farm owners
- International agricultural companies
- Fruit packing companies

Market Research

- Current global Rambutan market valued at \$500 million USD
- 6,000 Rambutan farms world-wide
- 25% annual increase in consumption in the last five years within the U.S
- Only 20% of global rambutan produce is exported due to strict USFDA regulations regarding cleanliness of fruits

Solution

An automated, closed-loop, 360° water jet cleaning system that is 40 times faster than current hand washing methods



Prototype Features

Gas Pump

- 20 hp
- Maximum flowrate of 290 GPM
- Maximum pressure of 220 PSI

Coils

- 8 threaded, weaved vinyl tubes
- 1/16" diameter drilled holes directed towards center of coil
- 20 holes per coil = 160 water jets

Filtering system

- Mesh filters water pouring at a system flow rate of 150 GPM
- Filters particle sizes $\geq 1/16"$

Support Stand

- Maximum weight of 500lbs
- Adjustable angles from 0° to 60°
- Rambutan counting sensor



Coil fabrication

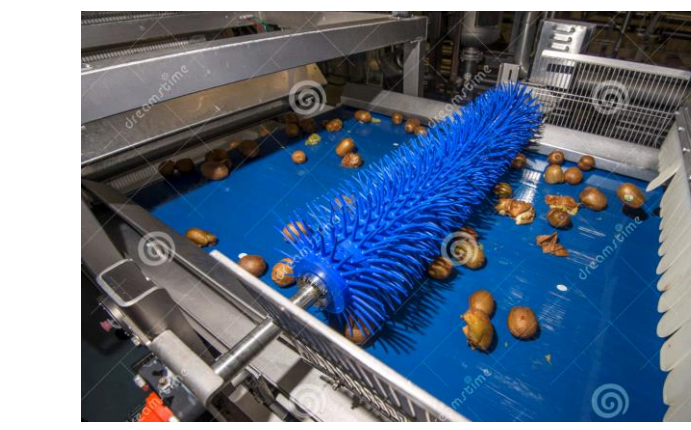


Final coil configuration

Performance of water jets

Efficient mesh filtration

Fruit Cleaning Benchmarks



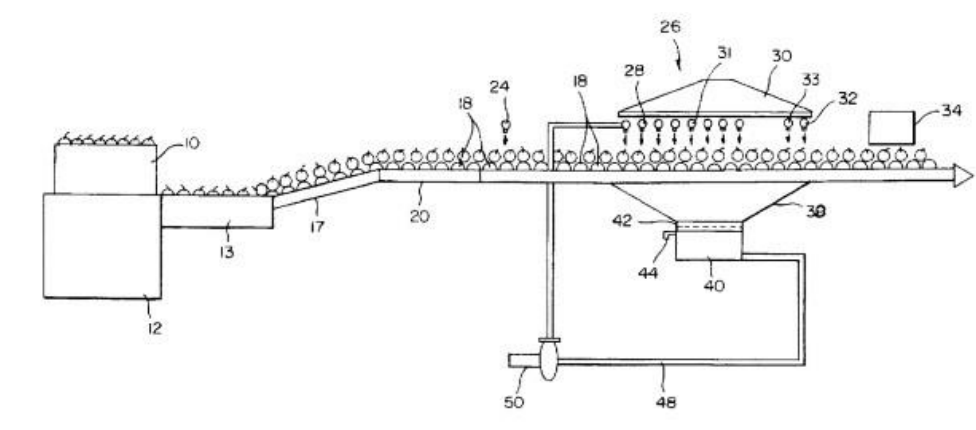
KIWI Vision Unitec Technology

- Rotating brushing technology
- Water misting



Polywash Multi-Produce Washer

- Submersion of product in water
- Pressurized air injections



Apple Cleaning System

- Pressurized water jets
- Conveyor belt

System Operation



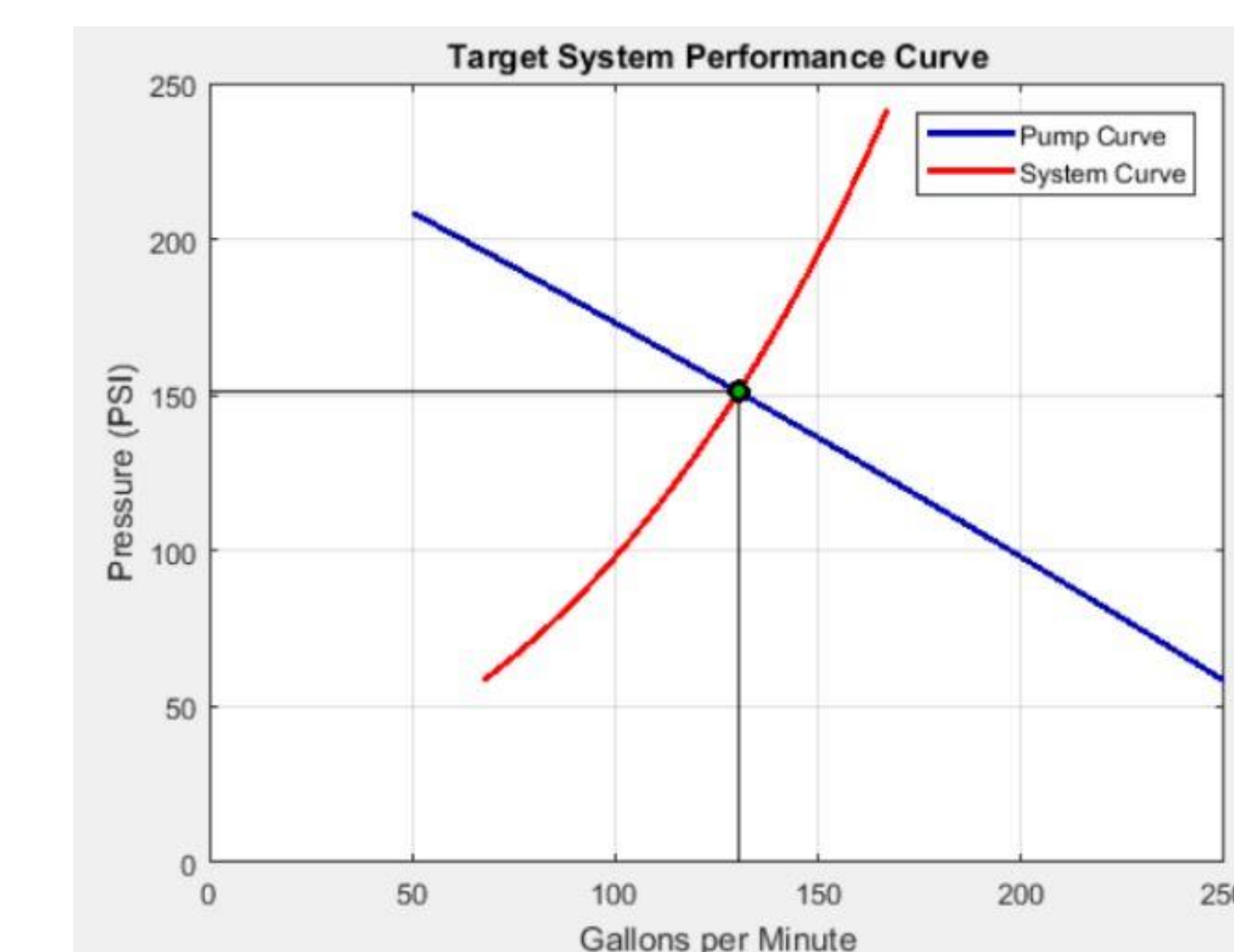
System entrance



System exit

Testing and Validation

Engineering Requirements	Target Value	Achieved Value
System Water Pressure	152 PSI	158 PSI
Jet Velocity	146 ft/s	153 ft/s
Volumetric Flow Rate	130 GPM	127 GPM
Filtering Rate	200 GPM	>200 GPM
Filtering Effectiveness (Particle size filtered)	1/16 in	1/16 in
Cleaning Rate (# of rambutan cleaned per minute)	100	120



Operating point of cleaning system

Future Product Improvements

- Incorporate an electric pump
- Professionally manufacture coils with different materials
- Incorporate multiple cleaning tubes