**Objective:**
Design a zero discharge 20MM Kg masa facility that minimizes waste water generation without compromising the quality of the final product.

**Background:**
- Staple of Latin American diet
- Used in tortillas, tamales, soups, corn chips
- Corn tortillas make up 60% of US tortilla industry
- Process facilities use 2 billion gallons per year

**Terminology:**
- Nixtamalization: alkaline cooking and steeping process
- Nixtamal: alkaline-cooked corn
- Nejayote: steep liquor rich in lime and pericarp

**Process Parameters:**
- Cooked at 103°C for 30 minutes
- Steeped at 75°C for 10 hours
- Rinsed with de ionized water
- Rinse water reused in process

**Experimental Design:**
- Tested 4 reuses of nejayote to determine the effect on masa quality
- Measured mass and value of corn, water, and solids
- Analyzed masa physical parameters
- Centrifuged nejayote to determine solids
- Saved nejayote and masa samples for future testing

**Results:**
- Total Overall Mass Balance
- Amount of Water Absorbed During Steeping

**Plant Scale-up:**
- Semi-continuous process with 12 4,000L steep tanks and 3 4,000L cookers
- Washing and grinding continuous process

**Added Improvements:**
- Reuse the rinse and steeping water in steeping process
- Filter solids from nejayote

**Possible Uses for Nejayote Solids:**
- Return to product stream to reestablish whole grain content
- Sell loose as animal feed or process into pellets
- Sell as compost material

**Benefits:**
- Reduce water waste by approximately 1.1 billion gallons per year
- Almost 2000 Olympic swimming pools!!
- Reduce waste water treatment load

**Estimation of Capital Investment:**

**Economics Summary:**

<table>
<thead>
<tr>
<th>Product</th>
<th>Mass Balance (kg)</th>
<th>Total Capital Investment ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nejayote</td>
<td>11,750,548.06</td>
<td>13,525,290.95</td>
</tr>
<tr>
<td>Nejayote solids</td>
<td>6,581,604.00</td>
<td>41,581,604.00</td>
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<tr>
<td>Nejayote process (kg)</td>
<td>23,376,478.00</td>
<td>23,376,478.00</td>
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<tr>
<td>Annual Production (kg/yr)</td>
<td>18,993,520.70</td>
<td>18,993,520.70</td>
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<tr>
<td>Product Cost ($/kg)</td>
<td>1.05</td>
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<tr>
<td>Selling Price ($/kg)</td>
<td>2.25</td>
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<tr>
<td>Return on Investment (%)</td>
<td>85.26</td>
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<tr>
<td>Payback time (yr)</td>
<td>1.13</td>
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<tr>
<td>NPV at 7.5% Int (€)</td>
<td>71,378,364.00</td>
<td>71,378,364.00</td>
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</tbody>
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