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2ND EDITION

# ZERO WASTE ENGINEERING



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[Figure 10.8: Biogas production with bacterial inoculums in psychrophilic temperature.](#)

[Figure 10.9: Biogas production with bacterial inoculums at 34 °C.](#)

## **Chapter 11**

**Figure 11.1: Kernels from mango.**

**Figure 11.2: Equilibrium concentration (mg/l) in 20 ml lead solution for 0.5 g mango kernels.**

**Figure 11.3: Freundlich isotherm.**

**Figure 11.4: Comparison of Freundlich model with experimental results.**

**Figure 11.5: (a) SEM of mango-stone kernels. (b) SEM of mango-stone kernels.**

**Figure 11.6: Effect of pH on lead adsorption.**

**Figure 11.7: (a & b) Effect of pH on desorption with mango seed (from Alencar *et al.*, 2012).**

**Figure 11.8: Adhesive market in USA in 1995 (Modified from Prane, 1996).**

**Figure 11.9: Sea shells collected from Point Pleasant Park, Halifax NS [Canada].**

**Figure 11.10: Quick-lime (CaO) after calcination of sea shells.**

**Figure 11.11: Mangosteen fruit.**

**Figure 11.12: Mangosteen fluids under microscope.**

**Figure 11.13: (a) Shearing tools. (b) Shearing tools.**

**Figure. 11.14: Adhesive application in maple blocks for shear stress measurement.**

**Figure 11.15: Drying time and bonding strength of honey to CaO ratio on wood surface joint.**

**Figure 11.16: Shear stress at bond failure with the age of adhesive.**

Figure 11.17: Experimental writing pad and commercial writing pad.

Figure 11.18: The test was the pulling strength of a single sheet in the writing pad, which was used to measure the strength of the sheets that were bound together by these adhesives. One single sheet was suspended from the stack of sheets (Figure 11.18) and then its pulling strength was measured by increasing force applied to the rest of the sheets. The minimum force required to separate a single sheet from the stack of sheet was observed and recorded as its minimum pulling strength.

Figure 11.19: Pulling force of a single sheet to separate from writing pad.

Figure 11.20: Fixing of broken ceramics with sugar and CaO mixture with water.

Figure 11.21: Fixing of broken ceramics with honey and CaO mixture.

Figure 11.22: Drying time and tensile strength of adhesive at different ratio.

Figure 11.23: Alternative to Plaster of Paris.

Figure 11.24: Blocks made up with sugar and CaO.

Figure 11.25: Particle board made up with honey and CaO as adhesive.

Figure 11.26: Sand blocks made up with sands and adhesive made up with sugar and CaO.

Figure 11.27: Sand block made up with sand and adhesive made up with honey and CaO.

## **Chapter 12**

Figure 12.1: Economics and accounting systems have to be reformulated in order to make stated value proportional to real value.

Figure 12.2: Price, quantity, supply and demand as per conventional economic theory.

Figure 12.3: Production-Cost and Market-Price Realities “At The Margin”

Figure 12.4: Trend of long-term thinking vs. trend of short-term thinking.

Figure 12.5: Bifurcation, a familiar pattern from the chaos theory, is useful for illustrating the engendering of more degrees of freedom in which solutions may be found as the “order” of the “phase space,” or as in this case, dimensions, which increase from one to two to three to four.

Figure 12.6: In the knowledge dimension, data about quarterly income over some selected time span displays all the possibilities - negative, positive, short-term, long-term, cyclical, etc.

Figure 12.7: Linearization of economic data.

Figure 12.8: When intangibles are included, the rate of return becomes a monotonous function of the investment duration.

Figure 12.9: Business turnover cannot be studied with conventional economical theories.

Figure 12.10: Payback period VS unit price of energy.

## **Chapter 13**

Picture 13.1: Greenery on the 1500 year old wall of Rize Castle (Turkey).