



Beverage Bombers

Flavor Vehicles for Carbonated Soft Drinks

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ABSTRACT

Carbonated soft drinks see increases in sales year after year due to the convenience and trendiness of the beverages. However, the flavored soda market is volatile. If manufacturing companies market a particular flavor at the onset of increased demand, sales can be tremendous. Nevertheless, the life-span of such products prohibits extended profits. With increased flexibility and decreased costs of manufacturing, a company could have the potential to increase market share with only a single product introduction. How would they do this? The answer is a flavor delivery vehicle such as a compressed tablet that can change the flavor of any classic soda to cherry, vanilla, or lime. The sky is the limit. To satisfy consumer demand, the plant will make approximately 2.41 billion pills per year. Based on a 300 day per year and 24 hr production schedule, this amounts to 1000 kg or 200,000 pills per hour.

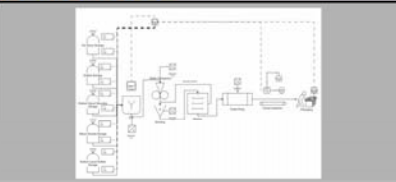
The plant requires \$5,000,000 of energy per year. Total equipment cost is approximately \$250,000. Installation of equipment and construction, with miscellaneous expenses, totals around \$500,000. Ingredients, the largest cost of production, cost a total of \$20,500,000. Annual salaries total \$1,700,000. With these figures and others the plant will be able to repay loans within 1.9 years. This would satisfy a 40% return on investment required by investors.

PURPOSE AND HYPOTHESIS

We can see that sales of carbonated beverages have a constant demand that continues to increase from year to year. What is of particular interest are the investments made by large soft drink manufacturers, including PepsiCo and Coca Cola, in new twists on classic soda flavors. Consider, for example, Crystal Pepsi, Vanilla Coke, and Lime Twist Pepsi. An alarming trend in sales of flavored soft drinks is the extreme volatility in "fad" flavors. In 2003 Vanilla Coke had tremendous sales of 90 million unit cases. However, after sharp decline in recent years, Coca Cola will pull this flavor off the market this year.

This senior design team sees a market niche that offers remarkable potential for sales. As seen above, large soft drink manufacturers see very large sales in flavored soft drinks. However, flavors are very short-lived due to their trendy nature. Adapting to the market is expensive and time consuming for soda manufacturing companies. Imagine a product that has the flexibility to adapt to the market in a relatively quick manner. If a company had a short turn-around time and consequently a jump-start on the sales, they could drastically increase market share over a very short period of time. As evidence of the future we point to a 2001 study that showed a 1.3 percent increase in Pepsi's market share (and corresponding 0.2 percent decrease in Coke's market share) after introduction of Code Red Mountain Dew (La Monica 2002). The objective of this project is to design a processing facility for the production of a flavor vehicle that allows rapid adjustment to market trends.

PLANT LAYOUT



PLANT DESIGN AND ECONOMIC ANALYSIS

DRYING: Three 7-11 cubic foot ribbon mixers (efficient for dry mixing) are needed. We will use model C11 made by Lowe Industries. This mixer runs at 55 rpm, requiring 3 hp, and ranges in cost from \$10,000 used and \$35,000 new.

Roller Compression/Milling/Grinding: A roller compressor, The Chiltonator Model IR-520, made by the Fitzpatrick Company will be used. An auger conveyor transfers the mixed powder into the hopper which feeds powder between two rollers. A thin compressed strip is formed which is then milled and sieved. This model is flexible in the amount of product that can be processed per hour and will cost around \$65,000.

Auger Conveyor: We will need 6 auger conveyors to transport dry material, resulting in a total cost of \$15,000. An auger conveyor from Sprockel Powder Handling Systems will allow powder product to move from storage to processing.

Tablet Press: Two tablet press machines (each producing 210,000-600,000 tablets/hour) will be used to process 1,000,000 tablets/hour. Tablet presses of this capacity cost around \$25,000 used, resulting in a capital investment of \$50,000. Some typical vendors include: Niro Inc., Amson Equipment Company, and Kiro.

Conveyor: An estimated 100 feet (5-20 foot long conveyors) of conveyor is needed for this at an estimated cost of \$1000 from Continental Conveyor.

Packaging: A horizontal form fill seal machine is desired for the packaging operation. This machine will fill small plastic bags with a set mass of tablets. Four packaging lines with the output of 200 bags/hour (5000 tablets/hour) will be needed to ensure continuous flow. Each machine costs approximately \$7500, resulting in a total investment of \$30,000. Packaging bags are 2x3 inch plastic 1.5 ply bags, which will cost 42,000/year plus another 85,000/year in shipping costs.

A profit and loss forecast was determined for the flavor delivery vehicle using information obtained from Petros 2003 and hand-outs including the CEPCI adjustments. The plant planning and financial bidding was performed in 2004. At this time approximately \$6,000,000 was obtained for use in the building of the plant in 2005. The costs in 2005 included the following: machinery, plant construction, hourly workers, energy costs, and interest costs on the loans. By the end of 2005, the plant used the 6 million dollars.

At the end of construction in 2005, the plant needed another \$1,000,000 in working capital to pay workers salaries and purchase ingredients. Additional expenses in 2006 include maintenance fees, shipping, packaging materials, energy costs, and the ingredients.

The largest cost incurred with production of the flavor tablets is associated with the purchase of the ingredients. Approximately \$20,000,000 a year is spent on the ingredients. The next largest expenses are the shipping and energy costs. The group was quite surprised at the insignificance of labor costs relative to the other production costs. As of yet the group has not taken into account the cost of health care and any retirement benefits the employees would receive. With health care costs spiraling, health care would be a definite issue that would have to be accounted in the cost analysis.

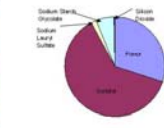
Any profit obtained from the pills is assumed to be taxed at a rate of 40%. In addition, a base inflation was taken to be at 4%. The cost of ingredients and workers' salaries were increased yearly by the inflation rate. The group decided to also increase the cost of the product by 4% per year. This hypothesis may not be factual, but serves as a good estimation. Maintenance cost increased 7% per year. Under this assumption it is evident that at some point in time, the equipment could be replaced with less expense than if the management decided to keep the older equipment and continue maintenance. If the price of machinery increased at only 4% and the maintenance increased at the rate of 7% a year it would be sensible to buy new equipment after approximately 10 years.

Tablet process step	Function	Cost
Active Ingredient Flow	Control Unit from V&S Form 25-2500	
Dribble	improves ability to collect during compression, helps prevent the start of a tablet	
Mixing	ensures tablets are homogeneous in content	
Roller Compression	compresses the powder into a long thin strip, making the powder bags, which will be in two separate tableting stages	
Milling	breaks up the long thin strip into manageable particles for tablet compression	
Filteration	filters out particles or powder of broken tablets	
Discharge	subdividing space that can be added to improve flow	
Labeling	prints the label on the other or top of the tablet, defines each when directed between two machines	
Discharging agent	disrupts the tablet structure and leads to disintegration	
Tablet Press	punches and presses ingredients to make tablets	
Packaging (horizontal form fill seal machine)	weighs out the correct amount of tablets, fills them into small bags, and seals the bags	

RECIPE

Flavor is the main component and can be cherry, vanilla, raspberry, lemon, lime or any other combination the research and development scientists specify. The diluent selected is sorbitol. This sugar alcohol was chosen because it can be directly compressed, is very soluble in water, and has a smaller heat of solution than the other sugar alcohols. The purpose of the diluent is to bulk up the tablet to a size that is appealing to consumers. The glidant, added to improve flowability, was chosen to be Sodium Lauryl Sulfate. This was selected because it is very water soluble and an effective glidant. A lubricant was added to prevent the tablet from sticking to the press. Silicon dioxide was chosen because it is common in the food industry and is effective in very small amounts. The disintegrant is Sodium Starch Glycolate. This disintegrant aids in rapid dissolution.

Component	Tablet mass
Flavor	100 mg
Diluent	61.1 mg
Sodium Lauryl Sulfate	15 mg
Sodium Starch Glycolate	60 mg
Silicon Dioxide	1.5 mg
DCU	100 mg



CONCLUSIONS

A large factor not taken into account was competition by rival companies. In all calculations we are assuming that we are the only player in the market. At any time competition for our product could hit the market and our market share could dramatically decrease. For example if another player entered the market and our market share was decreased by as little as 2% we would become unprofitable. In fact if competition entered the market in 2008 and our market share was reduced to 75% of its former level, the company would be in debt by 2009. Unfortunately, this would be a likely scenario for a small company. A patent on our product would be almost a necessity. However, a larger rival company could easily reformulate the tablet or make a similar product outside our patent protection. To remain profitable for an acceptable period of time 85% of the group's produced sales must be maintained.

BIBLIOGRAPHY

La Monica, Paul R. May 2002. *Coke vs. Pepsi: The New Cola Wars*. http://money.com.com/2002/05/10/pf/investing/q_cola/