



Name: Amel Amar

Graduated from: Adamson University, 1982

Education: B.S. Chemical Engineering (licensed)

In 2001, Mr Amel pioneered Maha Chemicals in Philippines (MCP) and presently holds the position of Director in MCP. Before joining MCP, he has worked with different companies located around Southeast Asia.

Upon graduating from Adamson University, Mr. Amel worked for General Synthetic in Philippines as a resin chemist for four years before joining Al Samae Ink in Saudi Arabia. He then moved on to the position as an R & D chemist for Al Samae Ink, Pacific Products, Dutch Boy and Resin Plus. After spending considerable time in the R & D field, he joined Dovechem in Singapore and Malaysia as factory manager.

With more than 25 years of knowledge, enthusiasm and experiences revolving in the Paint, Ink, Adhesive and Resin Industry, his contributions are remarkable.

PRODUCTION COST REDUCTION FOR INK INDUSTRY

Mr Amel article contribution to Ink Matter – in the Philippines

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It's one of the most important discussions over management meetings. And anyone involve in running the production knows well the importance of keeping the production cost at the most minimum. Overall, after the Raw Materials Cost, the main cost of production comes from Manpower, Utilities and other production overheads. In general, production cost is calculated as 15-20% of raw materials costs. Not so accurately measured, but somehow becomes a guide to the Plant Manager.

Three main factors greatly affecting the cost of production that needs to be addressed in order to achieve a good deal of cost savings for the company are the following: First, complete understanding of the whole process in production. Second, a good knowledge of machineries and its maintenance. And third, a good collaboration with the chemists and get a good understanding of the formulation itself.

There are other programs that can be added to above to cut costs such as the Japanese 5S program (Serei, Seiton, Seiso, Seiketsu, and Shitsuke), Time Management, Overtime Reduction, investment on a solvent recovery system, 3R's (Reduce, Re-use, Recycle), Skills Training Program, etc. All are definitely good programs that will surely give some cost savings on production budgets. But the discussion below will be limited to those three mentioned factors affecting cost of production.

PROCESS

There are 5-6 stages of production for a normal manufacture of ink. These are weighing of raw materials, pre-mixing, grinding, letdown, colour-matching and viscosity adjustment, and packing. Correct weighing of raw materials is the very first stage that production personnel must be taken care of well. Common sense dictates that wrong weights or wrong materials added to a batch will be disastrous and very expensive for the company.

Below are the important stages of production and some guides to a cost-effective operation. Not discussed here will be the production of intermediates and clear varnishes, which are basically mixing or dissolving or neutralization only.

Stages of production	Method	Cost reduction Tips
Weighing of Raw Materials	Individual weighing of raw material from the warehouse.	1. Calibrate regularly the weighing scales.
Pre-mixing # of personnel involve: 1	Process of mixing the initial ingredients of a batch such as pigments, varnish, additives and solvent.	1. Use of a high speed mixer and equipped with cowles cutting blades. 2. Use appropriate size of tub or mixing tank (jacketed if possible) for the batch in process. 3. Maintain speed of 1000–1200 rpm for 1 hour. A vortex must be observed during this process. 4. Maintain mixing temperature stated in the batch ticket.
Grinding or Milling # of personnel involve: 1	Process in which pigments are milled to finely dispersed particles in the medium. This process is where bottleneck in the production occurs.	1. Most efficient grinding can be achieved when there's enough shear created by the milling machine to the pre-mix. 2. Dedicated milling machine per colour is advisable to avoid in-between cleaning on colour turn-over. 3. Maintain milling temperature of the batch to room temperature to maintain the viscosity. Low viscosity will give you low shear. 4. After achieving the fineness of grind, flush the machine with the solvent to be used in the next stage.
Letdown # of personnel involve: 1	Process after grinding where the rest of the raw materials are added to the milled batch.	1. Use low to medium speed mixer. 500-600 rpm 2. Important to follow sequence of addition of raw materials in the formula to avoid 'pigment shock'. 3. Observe cleanliness in the work area.

Colour Matching (if any) # of personnel involve: 1	Process of mixing base colours to achieve a desired colour	1. The experienced colour matcher is the key to achieve speed in this process. 2. Train colour matchers in the laboratory.
Packing # of personnel involve: subjective and relative to batch size	Last stage of production after QC approval of the batch in process. Somehow not so noticeable, but can also be another bottleneck. Small size packaging for big and viscous batches may sometimes take more than 4 hours.	1. Systematic and good flow of labelled packaging materials should be observed. 2. Invest in pumps with built-in filtration system to speed up packing process.

GRINDING OR MILLING MACHINERIES

Speed of grinding is the main objective of every production operator. Achieving the desired fineness of grind (FOG) at the shortest possible time will provide ample energy savings to the company. Routine maintenance check is also a must to maintain efficient machine runs and avoiding downtimes. Not to be overlooked are the other units in the production floor such as cooling towers, chillers, machine belts, pumps, filters, weighing scales, air compressors, ground wiring, grinding media, and every nuts and bolts, each one are all important accessories that also requires routine checks.

Below are the different types of milling machines used in the production and a quick reference guide to efficient grinding.

Common Type of Machine	Suitability and guide to efficient grinding
Three-roller Mill	Suitable to viscous products such as offset and lithograph inks. 1. A quick 'loose-pass' is usually employed before engaging all the three mills at play on the pre-mix' second pass. 2. Always keep the doctor's blade sharp and clean. 3. Before the end of the cycle, loosely disengage the roller mills and wipe out the remaining inks adhering to the machine with suitable solvent.
Vertical Mill or Sand mill	Suitable to less viscous products such as rotogravure and flexographic inks. 1. Correct volume, clean and smooth spherical shape grinding media must be observed. Usually 70-80% of the grinding chamber is filled with grinding media, in this case glass beads. 2. A quick high speed feed (pump) is usually done as first pass or 'loose-pass'.

	<p>3. Second pass commence at a slow feed. Dwell time or contact time of the pre-mix with the grinding media is important to affect the required shear inside the grinding chamber.</p> <p>4. Temperature monitoring is a must. Maintaining the grinding temperature to <30 deg C is ideal.</p> <p>5. Use the solvent in the letdown stage to flush the machine after achieving the FOG.</p> <p>6. Re-check quantity and discard broken glass beads.</p>
Horizontal Mill	<p>Suitable to less viscous products such as above. This machine is the second generation of sand mills and will provide more efficient grinding.</p> <p>1. Same operation as Vertical Mills. But depending on the material of construction of the machine, normally better grinding media such as ceramic, zirconia and yttria can be used. These grinding media, though more expensive, are more durable and will last longer than ordinary glass beads.</p> <p>2. As product fed is tangent to the mill and more shears are developed inside the chamber, thus heat developed during grinding process is extremely high. Advisable to use chilled water for cooling on this machine.</p> <p>3. Cost savings will be realized on shorter grinding time and longer use of the grinding media.</p>

FORMULATION

Batch formulas are tested in the laboratory and results obtained will always be good before going out to production. Ideal conditions in the laboratory will provide the technicians the tools to arrive to a good product. But it may not always be the same in the production floor; hence there will be some difference in the finished products' results when upscale to a bigger batch. Experienced production workers will pro-actively alert their supervisors that a certain batch formula will take longer time in the milling when he observes that the viscosity of the premix is very low in viscosity. The operator can also determine sometimes that it will take longer time in colour matching certain error in pigment paste combinations. Sometimes also, even the size of the batch may not be sufficient to the smallest tub or tank size and will not give a good vortex necessary for effective mixing of raw materials. Technical department's R&D generally works also on cost reduction via substitution of cheaper but useable raw materials, development of higher solids products, improving the colour strength for better mileage, etc. If substituting cheaper raw materials is the only route, then the new formula must be discussed to the Production head for possible delays in production. There could be some cost savings in the formula, but the savings can easily be offset during production because of longer grinding time, for example. These production difficulties should be discussed closely with the Technical group.

In a nutshell, address all of the above components in the factory and this will give a great savings to the company. Happy Grinding!