

GOOD MANUFACTURING PRACTICE (GMP) IN CANE SUGAR FACTORIES

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Abstract

The South African industry in general, and sugar in particular, needs to be internationally competitive. This requires that the standards demanded by global customers are being met consistently. In the case of food products such as sugar, these standards are embodied in a code called Good Manufacturing Practice (GMP). Apart from ensuring safe food products of consistent quality, major benefits of GMP are reduced waste and enhanced profits. Strategies for introducing GMP in raw sugar factories and refineries are discussed in detail.

Introduction

To be competitive on the international sugar market it is essential to be a low cost producer. More than that, however, it is imperative to meet consistently the expectations of your customers (Griffiths *et al.*, 1997). Many importers of South African sugar serve a sophisticated, discerning public which demands a high quality, safe product. A systematic approach which defines root causes for variability in quality and has formal mechanisms in place that deal with these causes is likely to be more successful in satisfying the market expectations instead of a haphazard reactive mode of solving problems as they arise. Good Manufacturing Practice (GMP) is a structured methodology which aims to ensure that a manufacturing concern consistently produces a safe product which complies with specified quality criteria and legal requirements.

In order to assess to what extent GMP is practised in the South African sugar industry, the authors visited ten factories, of which five had back-end refineries and two packed raw sugar for domestic consumption. Superficial audits were conducted and the findings were communicated verbally to the management at the conclusion of the visits. In every case management was very enthusiastic about the potential benefits of GMP and requested more information. This paper is an attempt to communicate briefly how GMP can be introduced in a sugar factory.

What is GMP?

The guidelines for GMP were initially developed for pharmaceutical companies but were later modified for food production. For the latter purpose GMP aims to ensure foods free of extraneous matter such as glass, machine filings and insect parts. It is a code involving quality control procedures which enable producers to guarantee that their products are

manufactured under proper conditions of storage and sanitation (Jones, 1992). It can also be described as good housekeeping.

GMP also ensures the application of product specifications. The specifications can have a regulatory, commercial or in-house origin (Macrae *et al.*, 1993). It is a practical system to ensure that things are done 'right, first time, every time, and on time'. GMP can show how to redesign the process to eliminate potential errors (Uys, 1994).

In the United States of America, GMP is part of the Code of Federal Regulations. The regulations cover every aspect of food production, employee training, plant design, equipment specifications, cleaning, sanitation and quality assurance (Gould, 1994). In South Africa, GMP is not a regulation, but forms part of the Food, Disinfectants and Cosmetics Act of 1972.

How does GMP work?

GMP is more relevant to meeting most customers' needs than ISO (although ISO remains a requirement for some customers). Even though for food manufacturing concerns GMP should be part of a quality management system such as ISO 9000, it is found that many food factories which have ISO accreditation (including producers of raw and refined sugar) do not have an operating GMP system in place. The ISO 9000 system requires that each organisation sets its own quality standards, and correct implementation will ensure that these standards are met consistently. If the safety and health stipulations required by GMP do not form part of the company's quality criteria, then the company can be ISO 9000 accredited without performing GMP.

It is suggested to any organisation making food products that, before contemplating ISO 9000 accreditation, it ensures that GMP procedures have been implemented and are running successfully. GMP is more practical and involves less cost because it can be tailored to the factory's special needs without requiring much wasteful documentation. A food company which is ISO 9000 accredited and perceives that it does not have a formal GMP system is advised to follow the steps outlined in this paper to incorporate GMP.

In essence GMP is concerned with *how things are done*. It is a system of tools used to design, and build, safety and quality into the product. In an industrial operation it is impossible to achieve zero foreign matter inclusions in the product or zero package failures. These however cost a great deal, and the

most cost effective way to minimise these would be a committed GMP system. The philosophy behind GMP is that there are controls in place that ensure the attainment of the stated quality targets. For a food processing operation the minimum controls required include:

- personnel hygiene
- cleaning and sanitation
- waste management
- pest management
- management of foreign objects, chemicals and micro-organisms
- planned maintenance.

Do we need it?

Is GMP simply 'nice to have', or do sugar factories really need it? The extraction of sugar from cane and the production of pure white, or good raw, sugar involves a complex set of operations, the main aim of which is the removal of impurities. It is the function of sugar technology to remove the impurities originally present in the cane, but the aim of GMP is to ensure that no unnecessary, additional foreign materials are introduced during the process. Examples of the type of foreign materials which have been found in the final product are: bagacillo, dust, micro-organisms, welding globules, glass fragments, spiderwebs, bird feathers, fibres and paper from packing material, rodent faeces, insects, lubricating oil, cigarette butts, matches and a variety of other objects. In an era where the customer is king the detection of one or more of these in just a single batch of product can do irreparable harm to the economic wellbeing of the sugar factory. The question should not be, 'Do we need GMP?', but rather, 'Can we afford not to have it?' Apart from enabling a factory to satisfy the expectations of its customers, a GMP system has a number of additional benefits such as reduced waste, improved cost and production control, less re-work and improved staff motivation and performance.

How do we implement it?

Implementation strategies vary, but essentially there are five elements:

- Commitment and policy
- Planning
- Implementation
- Monitoring and verification
- Review and improvement.

These five steps are common to the implementation of all management systems and are used for ISO 9000 and hazard analysis critical control point (HACCP). The steps will be dealt with in turn.

Commitment and policy

It is essential that management are convinced of the need to introduce GMP. They must understand not only the benefits of GMP, but also appreciate the resources required to make it work. What is necessary is a clear understanding of what controls are already in place and what improvements need to

be made. Once the decision has been taken to introduce GMP, management will formulate a general GMP policy which will form part of the organisation's overall business plan and mission. This policy will not be cast in stone, but may be revised as more progress is made with the system. It will incorporate the company's vision, core values and beliefs and should take account of the image the organisation hopes to gain.

Once formalised the commitment to keep it going cannot be transferred and then ignored. It can be communicated by posters, incentive schemes, announcements, notices, articles in the organisation's newsletters and through media such as e-mail. The responsibility for the overall effectiveness would be given to a senior person who has sufficient authority and competence. He would set up a steering committee that would guide its implementation.

Planning

Careful initial planning is essential. It is necessary to appoint a champion to take charge of the implementation. That person's first step will be to set up a task force to investigate what needs to be achieved, draft a preliminary strategy, make a rough estimate of the resources required and consider allocation of responsibilities. The members of the task force must have appropriate knowledge, experience of operations and proficiency in auditing techniques. If the required competence is not available in the organisation, it will probably be necessary to send selected staff on short training courses or to use an outside consultant. The cost estimate will probably include staff and employee time, training needs, consulting assistance, materials, process modifications and a database for information management.

Before the task force commences setting objectives and making cost and resource estimates, it will conduct a preliminary GMP review to assess 'Where are we now?'. This may necessitate interviewing experienced personnel, seeing for themselves the state of different operations and using existing information systems on maintenance and inventory control. This review will identify those aspects of its operation which affect the quality of its final product. It is important to benchmark oneself against standards accepted worldwide, such as those drawn up by the American Institute of Baking (Anon, 1995).

The outcome of the review will be a set of prioritised objectives and targets and a management system to meet these. Examples of appropriate objectives for a cane sugar factory:

- minimise leaks from pipes, pumps, flanges and seals
- reduce bagacillo and dust levels in the crystalliser and drier sections of the factory
- minimise air draughts by which micro-organisms can be introduced to the production areas
- minimise spillages of sugar
- minimise damage to finished product
- minimise the presence of birds, rodents and insects in the packing station and warehouse.

Targets will specify measurable actions and incorporate time schedules or limits. Examples of targets are:

- there will be no bottles, cans, sandwiches or cigarette butts in the work area
- dust filters to sugar driers will be cleaned once a day during the morning shift
- the target for re-work of sugar from damaged packets will be less than x tons per month
- rodent bait stations will be checked once a week and results recorded in a designated file.

The task force will also consider training requirements and consulting services necessary for implementation of the system.

Implementation

Some of the major aspects that need to be addressed by a GMP in cane sugar factories include the following:

- Damage to packets in the warehouse must be kept to a minimum so as to avoid expensive rework of spilt sugar, and attraction of pests. Similarly, spillages from conveyor belts need to be minimised.
- The dust normally generated in a sugar packing station at conveyor transfer points and packing machines needs to be eliminated by installing dust extraction systems, because when sugar dust settles in the factory environment it is difficult to control bees, insects, birds and other pests. Furthermore sugar dust makes good housekeeping impossible.
- A policy on personnel hygiene needs to be drawn up and enforced. Wash basins with soap and clean towels need to be available in accessible positions, particularly near the packing station. Separate, closed rest rooms where staff can eat and drink, store their belongings and take showers must be provided. Eating, drinking and smoking in the work area should not be permitted.
- A planned (preventative) maintenance system will keep juice leaks to a minimum. Microbial contamination via juice recycled from the factory floor can lead to processing problems caused by microbial polysaccharides and can affect the quality of the final product. Informal (weekend) maintenance is unacceptable.
- Strong air currents within the factory, and particularly those that originate from outside the factory, must be minimised as they inevitably contain micro-organisms, soil particles, furnace fly-ash and bagacillo which contaminate the final product. Control of these air currents may necessitate structural modifications.
- Pipe lagging needs to be inspected regularly and steps taken to prevent deteriorated lagging material from entering product streams.
- Formalised cleaning schedules must be drawn up for the different work areas.
- Steps need to be taken to keep lubricants out of the process stream (e.g. massecuite).

- A policy on the control of glass will be necessary. Once glass has entered the process stream, particularly after the clarifier, it is virtually impossible to remove except by remelting and re-crystallising the sugar. All electric lighting near process vessels needs to be protected by perspex covers. No bottles should be allowed in the process area. Seed slurry should be dispensed from a stainless steel tank, not glass bottles.
- Formal procedures need to be established which deal with the different kinds of waste. Product that is spilt must be collected in special containers that will not be used for other types of waste. String and wrappings from packing material must be accumulated in designated areas and collected for recycling. Metal off-cuts, bolts and welding rods which are left over after minor repairs must not be left lying around.

Each of these aspects is dealt with by a three-tiered methodology:

Company policy – e.g. all sugar packers will wear white protective overalls.

Procedures – groups of documented instructions which explain concisely and clearly how the policies are to be achieved. Procedures are specific for a group of people, e.g. dress code.

Work instructions – these are procedures for individuals, e.g. how the operator will monitor on-line temperature.

At the commencement of implementation identified responsibilities are assigned to certain key people. These people require good human relation and communication skills, as well as intimate knowledge of their particular operation. They will have responsibility for involving the workers in their areas to help devise solutions to the problems that have been identified. The multi-disciplinary team approach is the only one that will work in the long term because those that have to run the system must own it. The solutions will include schedules, procedures and checks that ensure identified problems do not recur, or are contained. Fairly accurate estimates of resource requirements and equipment modifications can then be made.

Procedures need to be well documented so as to be easily available and understandable by those who have to implement them. A manual must be compiled which contains the GMP policy, objectives and targets, as well as the detailed procedures. Copies of the manual must be given to the main departments, but a procedure must be established whereby all modifications are inserted in their correct places in all manuals.

For budget and financial control purposes it may be beneficial to have a computerised tracking system which will record the major expenditure items and extra resources needed as well as the measurable benefits (e.g. reduced number of customer complaints, reduced breakdown time, reduced quantities of product that had to be re-worked) from the implemented GMP programme. This will facilitate estimation of return on investment.

Monitoring and verification

Monitoring involves checking that the procedures are being carried out effectively and that they achieve their objectives. Regular feedback on problems encountered in performing the required tasks, how these can be overcome and how the stipulated procedures could be improved must be given. Each department must determine how the feedback is best given. Only essential aspects of findings should be recorded. There is no benefit in collecting useless data. Where necessary, corrective action must be instituted as soon as possible. When this involves modification of existing procedures, these must be documented and incorporated in the manual. Application of this principle will help ensure that people do not become set in their ways and carry out their tasks without thinking, but contribute to making the system more effective.

Review and improvement

The review process requires that the food safety team conducts scheduled self inspections. It may be necessary that periodic inspections are undertaken by a third party to obtain objectivity. The inspections will identify quality improvement projects which in turn need to be planned, implemented and monitored. This begins the never ending cycle of quality improvement which is part of total quality management. Thorough reporting after the audits and formalised procedures for dealing with the audit findings are necessary.

Conclusions

The decision to introduce GMP into an organisation that is a major producer of a food product cannot be considered an option – it is a given.

GMP forms the basis for competitiveness. Without it the company may not realise its full market potential.

GMP lays the foundation for quality management and improvement.

Apart from guaranteed product quality, GMP has many economic benefits.

Proper implementation of GMP is likely to result in a change of culture which promotes a pro-active approach to production and quality control.

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