



Nordic Sugar
Member of Nordzucker Group

HACCP plan

on granulated sugar production



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1. Objectives

The objectives with this booklet are to

1. Explain and introduce Nordic Sugar's HACCP work to customers and authorities
2. Exchange general experiences with HACCP plans throughout the organisation
3. Create a common understanding of the HACCP method (calibration between factories)

The current HACCP plan addresses product safety associated with production of granulated sugar.

In the history of Nordic Sugar there has been no report of any food borne illnesses due to the consumption of sugar. Sugar can be considered a very safe product and is even used to protect other perishable foods from health hazards.

2. The method

The HACCP plans at Nordic Sugar are based on the GMP+ method (International Feed Ingredients Standard - IFIS) and the international food safety standard ISO 22000. We have taken every identified hazard in the whole process chain and evaluated them with regard to three basic steps in this method (the fourth step below is the verification of the system). This procedure has clarified where the hazard should be controlled, how the hazard should be controlled and what verification procedures are necessary.

1. Identification of chemical, physical, biological and allergenic hazards in each step of the process chain.

2. In a risk assessment (2.2.) the severity and probability of each identified hazard are combined to determine the risk class and the type of control method necessary.

3. By using the decision tree (2.3.) we have identified where the hazards should be controlled along the production chain. Based on the risk classes the decision tree is used to determine whether a given process step is a critical control point (CCP), a point of attention (POA/GMP) or just a periodic measure (PM).

4. Apart from product specifications, process diagrams, risk analysis tables and summary tables, also activities towards verification of the HACCP system are documented. These activities are e.g. audits, sampling and analysis of products, analysis of deviations and customer complaints.

2.1. Severity and probability

The severity of every possible hazard in the production chain has been estimated by the Nordic Sugar HACCP Reference Group independent of the current production process. The probability of each hazard is very closely associated with the processes and the current process equipment. The probability has therefore been determined by the local HACCP group at the factory.

2.2. Risk assessment matrix

Probability*	Severity		
	Small	Medium	Great
Great	3 POA Specific measures	4 CCP Critical measures	4 CCP Critical measures
Medium	2 PM General measures	3 POA Specific measures	4 CCP Critical measures
Small	1 No measures	2 PM General measures	3 POA Specific measures

* Refers to the probability of the hazard being present in the end product e.g. at the moment of consumption.

2.3. Decision tree

Where will the hazard be controlled?

- Q1: Are there identified hazards present which have a harmful effect on the safety of the product and/or can the hazard exist or increase to unacceptable levels?
Yes → Q2, No → stop!
- Q2: Which type of control measures are necessary according to the risk assessment?
Critical measures (class 4) → Q3, Specific measures (class 3) → include measures as POA and in verification procedures,
General measures (class 2) → include measures as PM and in verification procedures or no measures (class 1) → stop!
- Q3: Are the critical control measures referred to present?
Yes → Q4, No → Modify the process or product and start again at Q1.
- Q4: Has this process step been specifically developed to eliminate the risk or reduce it to an acceptable level? No → Q5, Yes → CCP!
- Q5: Will the risk be eliminated in a subsequent process step or will it be reduced to an acceptable level? Yes → Stop, No → CCP!

3. Identification of CCPs and POAs

The way Nordic Sugar differs between a CCP and a POA

CCP

- A high risk step, which is likely to get out of control
- Critical (and possible/applicable) control measures are needed in order to prevent, eliminate or reduce food & feed safety hazards to an acceptable level
- If measures are out of control the corrective actions must include isolation of product batch, retesting, decontamination or destruction
- The hazard is not eliminated or reduced to an acceptable level at a later stage in the process
- If not in control the end product constitutes a serious health risk

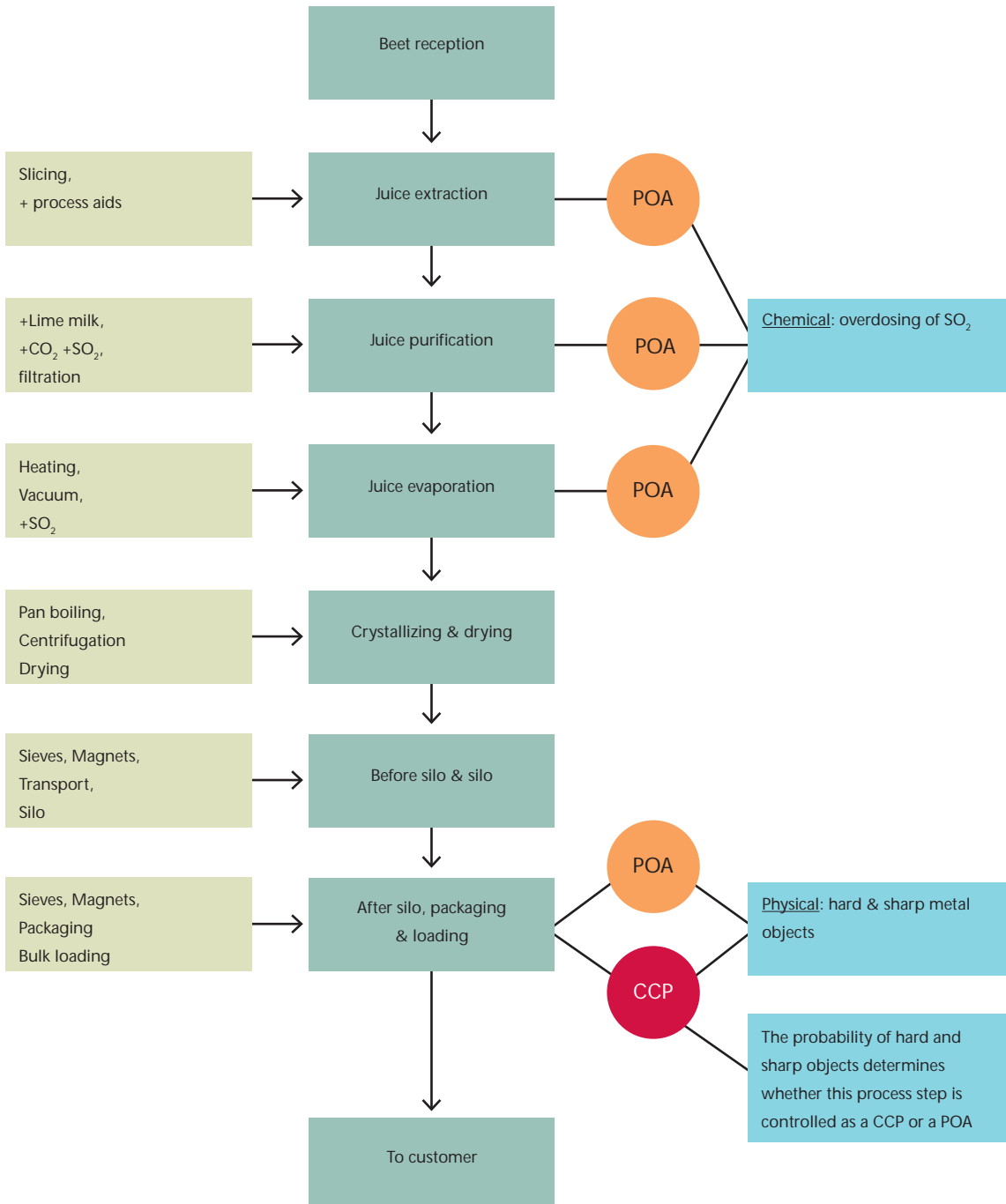
POA

- A moderate risk step
- Specific control measures essential to control the likelihood of introduction, contamination and/or proliferation of food & feed safety hazards
- The hazard may be reduced at a later stage in the process
- If measures are out of control the corrective actions include reevaluating procedure and/or checking equipment

In total four POAs and one CCP have been identified for the production of sugar at an arbitrary Nordic Sugar factory (see 3.1. Sugar production process). Whether any of our factories have actually confirmed the existence of the CCP and POAs, is however dependent on the characteristics of the factory i.e. equipment, specific production parameters, intended use of the product etc.

3.1. Sugar production process

General process steps and description of CCPs and POAs



See description of hazards, control measures, action limits and corrective actions for these process steps in table 3.2. and 3.3.

3.2. Hazard analysis table (risk evaluation)

	Processing step	Potential Hazards introduced, controlled or enhanced at this step	Control measures applied at this step to prevent/reduce/ eliminate the hazard.
1	Juice extration	1. (C) Overdosing of SO2 11. (B) Survival of pathogenic microorganisms 111. (P) Presence of hard & sharp objects > 25 mm	1. Control of SO2 by automatic dosing system 11. Controlled at juice purification & evaporation step 111. Controlled at juice purification & evaporation step
2	Juice purification	1.(B) survival of pathogenic microorganisms in thin juice 11. (P) Presence of hard & sharp objects > 25 mm 111.(C) Overdosing of SO2	1. Temperature, pH and time of purification of thin juice. Also controlled at juice evaporation 11. Filtration 111.Control of SO2 by automatic dosing system
3	Juice evaporation	(C) Overdosing of SO2	Control dosing of SO2 by pH measurement
4	Crystallizing & drying	(B) Survival and growth of pathogenic microorganisms at centrifugation	Temp. in centrifuges > 45-50°C (prevents growth of pathogenic microorganisms)
5	Before silo & silo	(B) Growth of moulds - mycotoxin formation in silo	Conditioning of sugar in silo by air ventilation (temperature and humidity)
6	After silo packaging & loading	(P) Presence of hard and sharp objects 3-25 mm	Running sugar through sieves combined with magnets and/or metal detectors

* Refers to the questions in the Decision tree (see 2.3. Decision tree).

B=Biological

C=Chemical

P=Physical

SM=Specific measures

CM=Critical measures

GM=General measures

Evaluation of hazard

Severity and probability in the risk assessment matrix gives the risk class

Is this step a critical control point?

	Decision tree questions 1 / 2 / 3 / 4 / 5*	CCP/POA/PM Comm. / Ref.
<p>1. Great x small = 3</p> <p>11. Great x nil</p> <p>111. Great x small = 3</p>	<p>1. Yes / SM → POA</p> <p>11. No → STOP</p> <p>111. Yes / SM → "POA"</p>	<p>1. Juice extraction is a POA for chemical hazards</p> <p>11. No control measures at this step</p> <p>111. Controlled at the juice purification & evaporation step, so not treated as a POA here</p>
<p>1. Great x nil</p> <p>11. Small x medium = 2</p> <p>111. Great x small = 3</p>	<p>1. No → STOP</p> <p>11. Yes / GM → PM</p> <p>111. Yes / SM → POA</p>	<p>1. No control measures at this step</p> <p>11. Filtration is a PM for physical hazards</p> <p>111. Purification is a POA for chemical hazards</p>
<p>Great x small = 3</p>	<p>Yes / SM → POA</p>	<p>Evaporation is a POA for chemical hazards</p>
<p>Great x nil</p>	<p>No → STOP</p>	<p>No control measures at this step</p>
<p>Great x nil</p>	<p>No → STOP</p>	<p>No control measures at this step</p>
<p>Medium x medium = 3 or Medium x great = 4</p>	<p>Yes / SM → POA or Yes / CM / Yes / Yes / No → CCP</p>	<p>Magnets and/or metal detectors in addition to sieves are controlled as a POA or a CCP dependant on the propability of the hazard</p>

3.3 HACCP Summary table

CCP or POA	Process step	Hazard to control	Control Method	Frequency
1 POA	Juice extraction	Overdosing of SO ₂	Process automation system: correct addition SO ₂ and pH measure	Continuously
2 POA	Juice purification	Overdosing of SO ₂	Process automation system: correct addition SO ₂ and pH measure	Continuously
3 POA	Juice evaporation	Overdosing of SO ₂	Process automation system: correct addition SO ₂ and pH measure	Continuously
4 POA CCP	After silo, packaging & loading	Presence of hard & sharp objects 3-25 mm	Control that sieves are whole and not damaged	Every X day
		Presence of hard & sharp metal objects 3-25 mm	Specific method to check the magnet or metal detector efficiency (test objects identified or caught)	Every shift

Action limit

Corrective action

- when action limit is exceeded

Responsible

Reference

Target limit: pH=4,5
Action limit: max SO₂, pH#norm

Evaluate sugar with high SO₂ content
- discard if necessary

Process operator

Local instructions for activities covering this area.

Target limit: min SO₂ and/or 8.8 < pH < 9.0
Action limit: max SO₂ and/or pH < 8.8 or pH > 9.0

Evaluate sugar with high SO₂ content
- discard if necessary

Process operator

Local instructions for activities covering this area.

Target limit: min SO₂ and/or pH=norm
Action limit: max SO₂ and/or pH norm

Evaluate sugar with high SO₂ content
- discard if necessary

Process operator

Local instructions for activities covering this area.

Target limit: sieves are not damaged (criteria).
Residues in sugar is being discard/reworked.
Action limit: Damaged sieves

Period with damaged sieves is evaluated in association with magnet/metal detector activity. Rework sugar if necessary.

Process operator

Local instructions for activities covering this area.

Target limit: The objects are being identified/caught by magnet or metal detector
Action limit: Test objects are not identified by magnet metal detector

If POA step: Evaluate the risk product
- rework if necessary
If CCP step: The batch since last positive test should be "re-sieved" and/or re-tested with metal detector

Process operator

Local instructions for activities covering this area.

4. Verification process

Sustaining a high quality and secure HACCP system requires continuous evaluation and review of the system.

A Nordic Sugar review of the risk analysis and verification of the HACCP plans consists of the following elements:

- Trend analyses of monitoring of POAs and or CCPs e.g. how often do we identify broken sieves

- Sampling and analysis of end products as a part of our quality program.
- Evaluation of complaints and/or emergencies reported to Nordic Sugar.
- Internal and external audits.

Audits -with focus on e.g. hygiene and HACCP are performed by internal and external parties.

These elements are used to verify the current HACCP plans at the different production sites. The verification is done whenever necessary and at least once a year.



5. Documentation

In the description of our HACCP system the following documents are included:

- HACCP team documents (members and areas of expertise)
- Flowcharts i.e. process diagrams
- Hazard analysis tables
- HACCP summary tables (comprising exclusively POAs and CCPs)

These documents are handled in the document management system (DMS) for each factory. The product safety manager located at the production site supports the management and updates the documentation. Deviations from criteria set for CCPs/ POAs are reported and registered in a Deviation Database and/or the Laboratory Information Management

System (LIMS) or Production Information Management System (PIMS). Deviations identified at the factories (at e.g. audits) are reported and communicated in a Deviation Database. Customer complaints are registered in a similar database, "Sugar Complaints for sugar, Fibrex and animal feed products".





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