RECLIME®

LIME RECYCLING & REACTIVATION

Recycling and reactivation of calcium compounds (Ca^{2+}) during the raw juice purification process in the production of white sugar.

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RECLIME® Recycling Unit

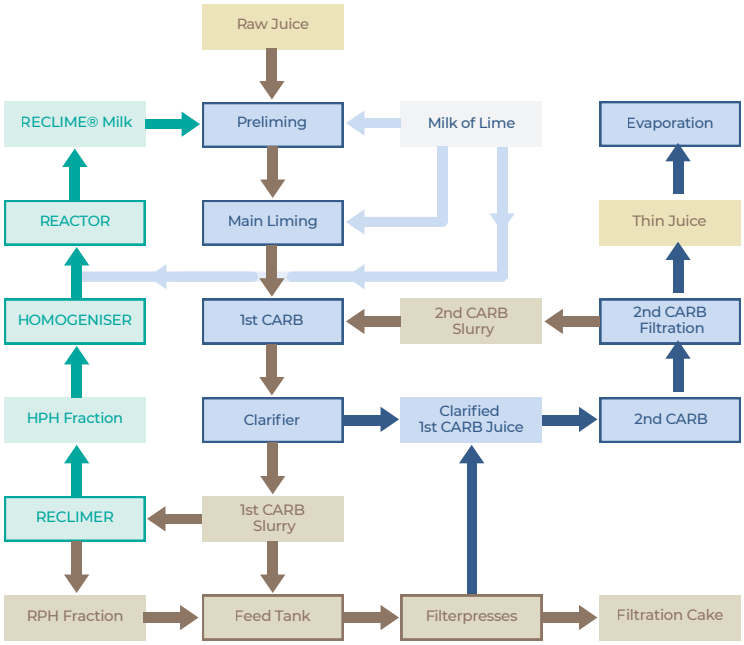
Unique and innovative system for effective raw juice purification, supporting decarbonisation and resource efficiency.

Progressive and Effective Purification Method

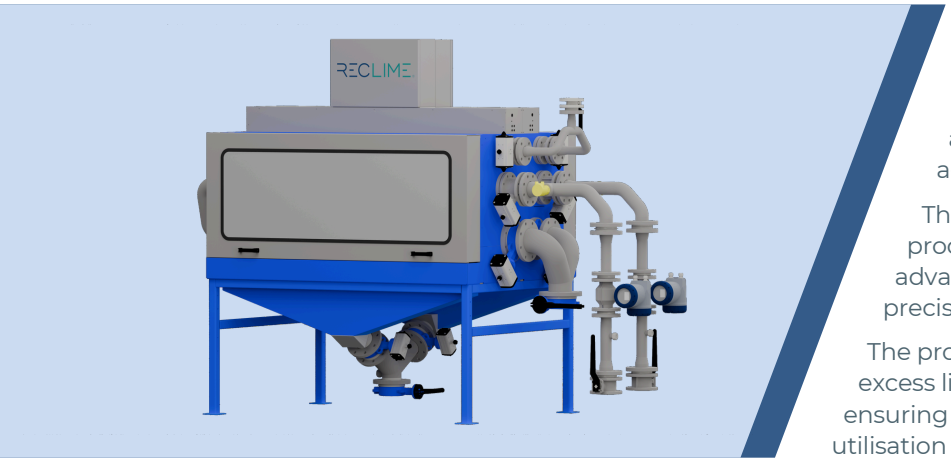
The RECLIME® system achieves a high level of raw juice purification through the progressive recycling and reactivation of calcium compounds (Ca^{2+}).

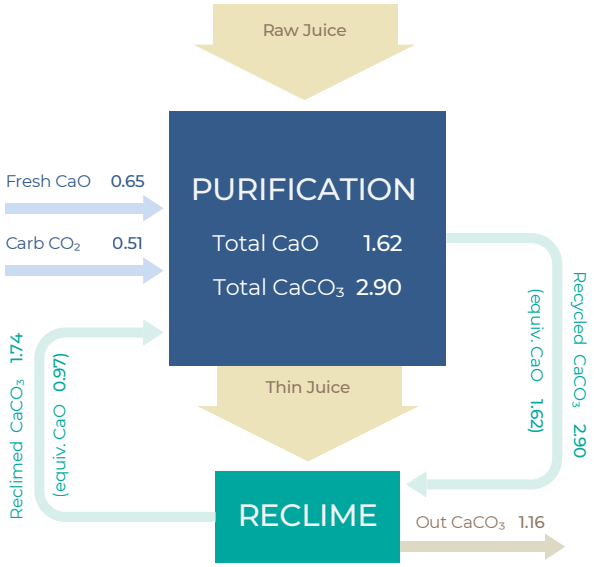
By reusing calcium compounds already present in the process, it reduces fresh lime (CaO) consumption to approximately 0.4–0.8% per beet, depending on operating conditions.

The system supplies the purification process with optimally dosed calcium compounds of the required composition and high adsorption capacity, while enhancing sedimentation of carbonation precipitates and improving filtration performance.



Scheme 2: Integration of the RECLIME® system into juice purification in a sugar factory.





Scheme 1: Calcium compounds (Ca^{2+}) balance during juice purification (% per beet).

In the purification process, the RECLIME® system continuously recycles calcium compounds (Ca^{2+}), mainly in the form of crystalline calcium carbonate ($CaCO_3$) with adsorbed non-sugars, separated as carbonation slurry. This enables the substitution of fresh lime (CaO) by recycled calcium compounds within the purification process.

A selected portion of the carbonation slurry is hydromechanically processed and divided into two flows in a patent-protected RECLIMER (hydrocyclones): a concentrated $CaCO_3$-rich fraction (HPH) suitable for recycling, and a lighter fraction (RPH) containing the majority of non-sugars.

The RECLIME® system uses the HPH fraction for controlled recycling. Chemical reactivation is achieved by the addition of milk of lime, containing active lime (CaO), with continuous processing into RECLIME® milk in the REACTOR.

RECLIME® Milk for Enhanced Purification

RECLIME® milk is applied at selected stages of the purification process, particularly during preliming. It acts as a filtration and purification agent with high adsorption capacity for non-sugars and strong agglomeration properties.

The RECLIME® system provides real-time process monitoring and control. It integrates advanced automation and digitalisation to ensure precise and reliable dosing of RECLIME® milk.

The process is continuously monitored to prevent excess lime (CaO) at any stage of purification, ensuring consistent process conditions and optimal utilisation of calcium compounds.

Advantages and Benefits of the RECLIME® Unit

- Reduced limestone and coke consumption by up to 60%
- Reduced milk of lime consumption by up to 60%
- Reduced filtration cake volume by up to 60%
- Reduced number of filterpress cycles by up to 60%
- Reduced sugar losses in filtration cake by up to 60%
- Reduced water demand for desweetening and lime slaking
- Reduced energy consumption for thin juice evaporation by up to 5%
- Reduced CO_2 emissions by up to 60%
- Improved sedimentation rate of first carbonation juice in the clarifier
- Reduced pumping demand due to lower process flows
- Reduced wear and load on key equipment
- Reduced CAPEX for lime and milk of lime systems
- Real-time process control ensuring stable purification
- Increased competitiveness through lower operating costs

Expected Economic Indicators

Parameter name	Unit of measurement	Standard operation without RECLIME® system	With RECLIME® system	
			RECLIME® operation	Savings of 35%
Daily beet processing capacity	t/ day	10 000		
Campaign duration	days	120		
Processed beet	t/ year	1 200 000		
Non-sugars content per beet	% per beet	1.50		
Limestone consumption for purification	t/ year	24 000	15 600	8 400
Coke consumption for purification	t/ year	2 280	1 482	798
Total cost of limestone	EUR/ year	768 000	499 200	268 800
Total cost of coke	EUR/ year	1 096 224	712 546	383 678
Lime (CaO) cost for purification	EUR/ year	1 864 224	1 211 746	652 478
CO_2 emissions cost for purification	EUR/ year	769 208	499 513	269 695
CO_2 emissions cost from carbonation cake	EUR/ year	529 892	333 511	196 380
Extra energy demand for evaporation	EUR/ year	222 395	144 194	78 202
Total costs	**EUR/ year**	**3 385 720**	**2 188 964**	**1 196 756**
CaO addition in preliming	% per beet	0.27	0.27	0.00
CaO addition in main liming	% per beet	0.73	0.38	0.35
Total CaO for purification	**% per beet**	**1.00**	**0.65**	**0.35**
CaO quicklime consumption	t/ year	12 140	7 891	4 249
Milk of lime consumption	t/ year	90 665	58 932	31 733
CO_2 emissions cost for purification	t/ year	9 615	6 244	3 371
Filtration cake production	t/ year	33 623	21 162	12 461
Number of filterpress cycles	cycles/ year	6 725	4 232	2 492
CO_2 emissions cost from carbonation cake	t/ year	6 624	4 169	2 455

Table 1: Expected economic indicators and operational savings for the RECLIME® system in a model sugar factory.

The installation and operation of the RECLIME® system result in significant operational cost savings through reduced consumption of lime (CaO), raw materials, and energy.

Fresh lime (CaO) consumption can be reduced by 25–60% compared to conventional operation, depending on process conditions. The expected return on investment for a RECLIME® unit is typically 4–6 years.

For a sugar factory producing approximately 100,000 tonnes of sugar annually, the application of the RECLIME® system can reduce limestone consumption by 4,670 tonnes, coke consumption by 440 tonnes, filtration cake production by 6,920 tonnes, and total CO_2 emissions by 3,240 tonnes.

This corresponds to operational cost savings of €3.5–6.2 per tonne of white sugar produced.

In addition to these economic benefits, RECLIME® delivers a measurable reduction in environmental impact and resource use.

RECLIME® reduces CO_2 emissions, raw material demand, and transport requirements through lower consumption of limestone, coke, and reduced filtration cake production in the purification process.

Under typical operating conditions, this corresponds to a reduction of 3.5–6.9 tonnes of CO_2 per 1,000 tonnes of processed beet, together with a reduction in transported raw materials and by-products of 13–26 tonnes per 1,000 tonnes of processed beet.

For a sugar factory processing around 1.2 million tonnes of beet per campaign, this represents a reduction of 5,830 tonnes of CO_2 emissions and a decrease in transported materials of 21,660 tonnes annually.

Collaboration and Research Activities

UNIVERSITY OF PARDUBICE FACULTY OF CHEMICAL TECHNOLOGY

UNIVERSITY OF CHEMISTRY AND TECHNOLOGY PRAGUE

FACULTY OF MECHANICAL ENGINEERING CTU IN PRAGUE

Faculty of Science
Palacký University Olomouc

We Are a Member of

CZECH SUGAR ENGINEERING

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