

Reduction of beer value chain's environmental impact with the use of proline specific endo-protease (PSEP)*: a comparative Life Cycle Analysis (LCA) screening of PSEP in beer production

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PSEP is traded under the name of Brewers Clarex™ produced uniquely by DSM & covered by protective patents

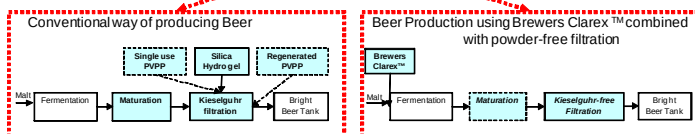
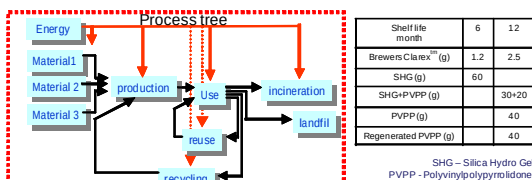


Introduction:

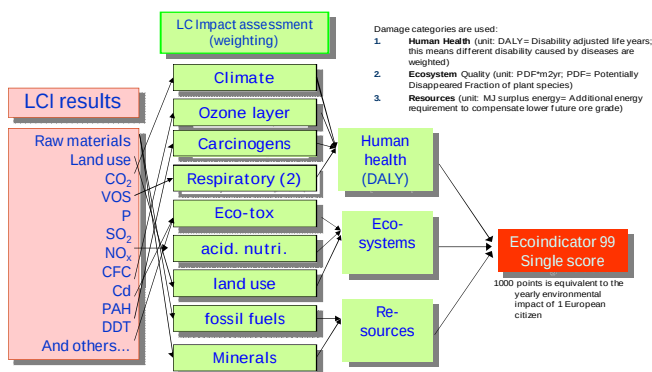
PSEP (commercial name Brewers Clarex™) enables Brewmasters to significantly lessen their CO₂ footprint by reducing energy cost, water consumption and raw materials usage in beer production. In a Life Cycle Analysis (LCA) all emissions released into the environment and resources consumed along the whole life cycle of beer are added up to produce an inventory list of substances. This inventory is translated with the help of an impact assessment methodology into environmental impacts. This study used two methods: Eco-indicator 99 and IPCC 2001 - for calculating all the impacts and performing sensitivity analysis, respectively.

Eco-indicator 99

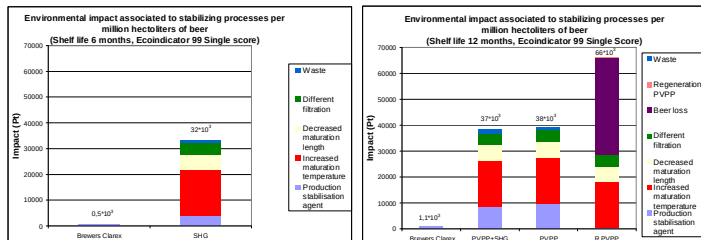
One of the most used methodologies worldwide
Measures the equivalent yearly environmental impact of 1 European citizen



Study includes the beer production steps which are subject to change with use of Brewers Clarex™



Eco-indicator 99 single score" represents aggregation of wide range of environmental effects into 3 damage categories



Environmental impact of Brewers Clarex™ process is 66 fold* lower compared to other synthetic stabilizers processes
Main environmental savings related to increased maturation temperature which is mainly impacting on: energy, climate change, fossil fuel depletion.

*: depending on stabilizer system and shelf-life requirement

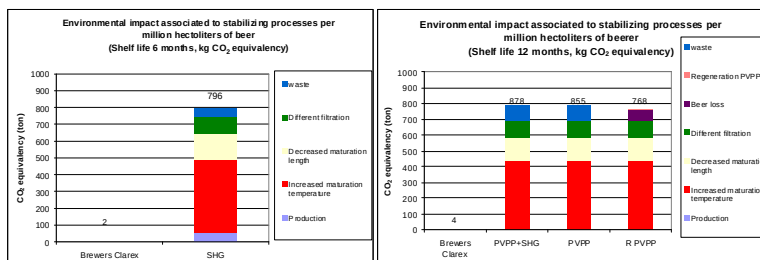
IPCC 2001 GWP (Intergovernmental Panel Climate Change)

Measures the equivalent emissions of CO₂
Conclusions with IPCC methodology is same as with Eco-indicator 99

	6 months shelf life Min HL		12 months shelf life Min HL			
	Brewers Clarex (1.2 tons)	SHG	Brewers Clarex (2.5 tons)	PVPP	SHG + PVPP	R. PVPP
CO ₂ eq. (ton)	2.01	795.99	4.20	855.01	877.71	767.90
Primary energy (*10 ³ GJ)	0.13	17	0.3	19	19	23
EI 99 (*10 ³ Pt)	0.5	32	1.1	38	37	66

All gasses that have a global warming impact are converted to the correlating amount of CO₂ using IPCC methodology which focuses on global warming

IPCC method also validates results of Eco-indicator 99: Brewers Clarex™ saves the environment



Main environmental savings are associated to increased maturation t* which is mostly impacting on energy, climate change, fossil fuel depletion

Conclusion of the comparative Life Cycle Analysis:

Both Eco Indicator 99 and IPCC 2001 GWP methodologies indicate that over the entire beer production chain Brewers Clarex™ saves the environment:

Brewer perspective: Environmental impact associated to the beer stabilization process is reduced by 5-8% when using Brewers Clarex™ compared to other synthetic stabilizers

Supplier perspective: Environmental impact of the production of Brewers Clarex™ is 7- 10 fold less compared to the production of other synthetic stabilizers

Beer value chain perspective: Over the entire beer value chain the total reduction on environmental impact using Brewers Clarex™ compared to PVPP and SHG is about 2 %. This is a small but significant figure, since beer stabilization accounts for less than 1% of the total environmental impact of the beer value chain.

