

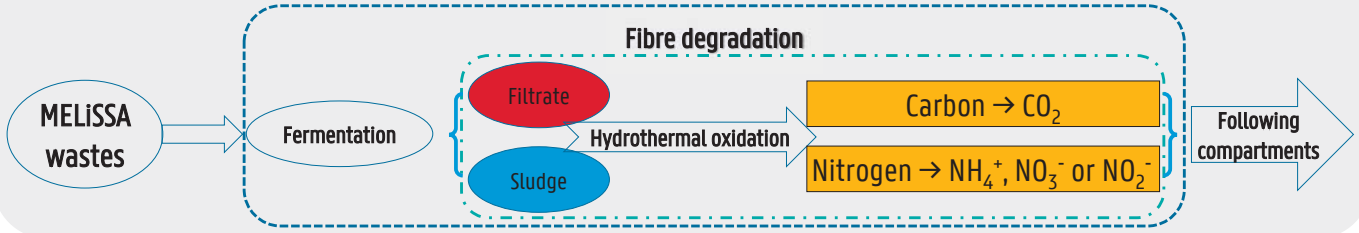
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CARBON AND NITROGEN RECOVERY BY HYDROTHERMAL OXIDATION

Research objectives



Methods and materials

Filtrate			
Temperature (°C)	Residence time (s)	OER*	
300	48, 58, 68	1	
340	38, 48, 58	1.5	
360	38, 48, 58	3	
380	28, 38, 48	4	

*Oxygen equivalence ratio
Continuous reactor

Filtrate conversion in a tubular reactor

Filtrate and sludge were conducted under different reactors and operational parameters. Clear and transparent aqueous effluent were produced. Gas composition, nitrate, nitrite and ammonia concentration were measured.

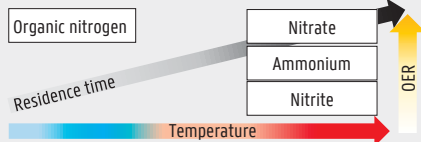
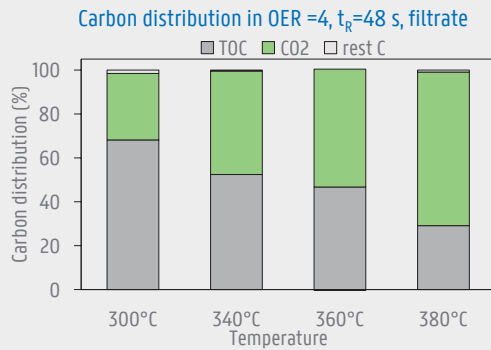
$$\text{Carbon recovery} = \frac{[C]_{CO_2}}{[TOC]_{feed}} \times 100\%$$

Sludge			
Temperature (°C)	Residence time (s)	OER*	
300	60	0,5	
400	300	1	
450	600	1,5	
500	600	2	

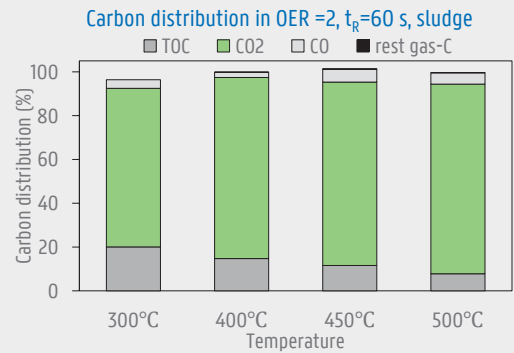
*Oxygen equivalence ratio
Batch reactor

Sludge conversion in a auto-clave reactor

Results and conclusion



No solids were found in final products, carbon dioxide was the only carbon gas. Carbon recovery of filtrate was lower compared sludge oxidation. Ammonium was the main nitrogen product and no nitrogen was lost in gas phase. Nitrate was slightly converted in given conditions.



Some carbon was kept in solid products in low temperature and low OER cases. Carbon dioxide and carbon monoxide could be found in most gas effluent. Longer residence time could increase carbon recovery but at low rate. Organic nitrogen was mostly converted to ammonia with increasing temperature and prolonged residence time, however, along with high conversion to N₂ and NO_x.

Conclusion

Sludge contains large number of undecomposed fibres from MELISSA wastes. It was injected into a batch reactor. Higher temperature, longer residence time and higher OER all could have positive effect on carbon recovery. Nevertheless, nitrogen distribution was greatly affected by temperature, more than half of the nitrogen was converted to gas products when carbon recovery was at its maximum of 97,1%. The balance between carbon and nitrogen recovery of sludge has to be considered.

Filtrate was mainly composed of volatile fatty acids. The maximum carbon recovery of filtrate was 68,2%. Nitrogen was all found in aqueous effluent. Nitrate conversion was low. Longer residence time is promising to increase both carbon and nitrogen recovery at mild supercritical temperature.