

Applications

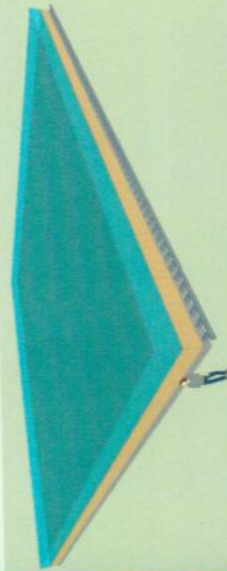
- Based on my results, **400 Olympic swimming pool-sized SSF bioreactors could potentially bioremediate the NAs in all oil sands tailings free water in less than 20 years** (14 times faster than PBC bioreactors).
- The area of these proposed bioreactors (0.007 km²) would be 4/100 000ths of the total area currently occupied by oil sands tailings ponds ^[3].
- The significance of my SSF bioreactors' efficiency at biodegrading NAs is the discovery of a sustainable and easily implementable way to reduce the toxicity of the constantly-expanding volume of oil sands tailings.
- Despite their simple design, SSFs have been used for reliably processing large volumes of water in conventional applications for centuries ^[2], so they would likely perform well in this unconventional application.

Did you know?

- **Three m³ of water are used for every one m³ of mined oil sands ore that is processed** ^[4].
- This clean water recovered from the tailings ponds could be reused to reduce the overall freshwater footprint of the oil sands industry.
- With oil sands development expected to accelerate in the near future, this technology could decrease the detoxification of the free water covering tailings ponds from centuries



The area of 400 Olympic swimming pool-sized SSF bioreactors (red) viewed from above with four oil sands tailings ponds shown for scale.



A computer model of a single Olympic swimming pool-sized SSF bioreactor with a person shown for scale.

References

- [1]. Whitby, C. (2010). Microbial naphthenic acid degradation. *Advances in Applied Microbiology*, 70, 93-125.
- [2]. Ellis, K., & Wood, W. (1985). Slow sand filtration. *Critical Reviews in Environmental Control*, 15, 315-354.
- [3]. The Pembina Institute. (2012). *Tailings*. Retrieved on 24 April, 2012 from http://www.pembina.org/oil-sands/os101/tailings#_edn3
- [4]. Headley, J., Peterson, H., & Quagraine, E. (2005). In situ bioremediation of naphthenic acids contaminated tailing pond waters in the Athabasca oil sands region – demonstrated field studies and plausible options: a review. *Journal of Environmental Science and Health*, 40, 685-722.

[Diagram of slow sand filtration]. Retrieved from <http://www.drinking-water.org/assets/400x/00000294.jpg>

Retrieved from <http://www.freshwater.org/>

Waste to Water

Biodegrading

Naphthenic Acids using

Novel Sand Filter Bioreactors



Hayley Todesco