

**Investigating the bacterial profile in donkey dung-
assisted anaerobic bioreactor remediation of
tannery chromium wastes**

Methodology

Effluent and Donkey dung sampling

❑ *Cr effluents were sampled* from the DB and BO tanneries.

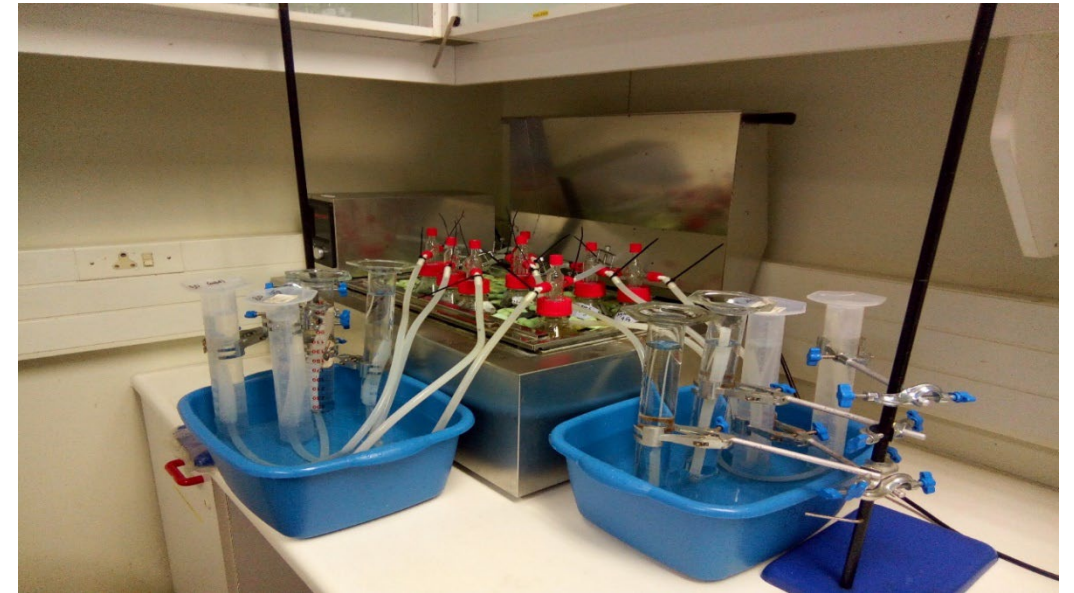
❑ *Donkey dungs were sampled* from *Equus africanus asinus* species bred at Vuwani in SA.



Experimental design and treatment

❑ *Batch set-up* using 500 mL anaerobic digestion glass bioreactors

❑ Samples for *physico-chemical and biological* analysis were collected at day 0, 7, 14, 21 and 30.



Result

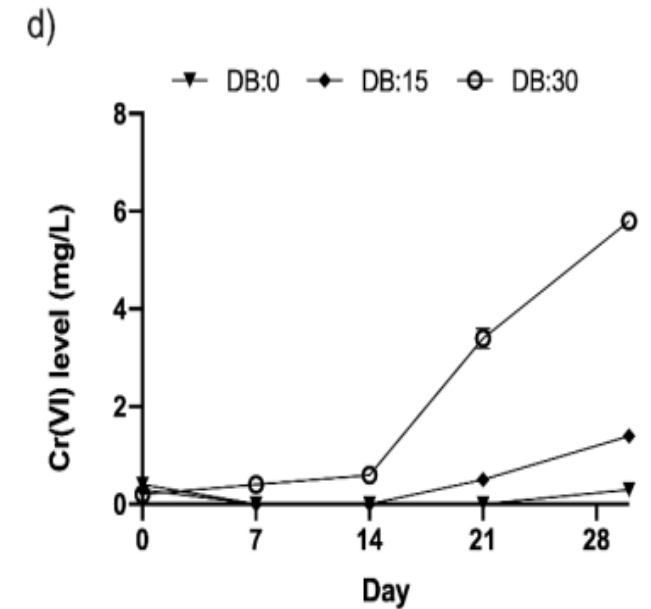
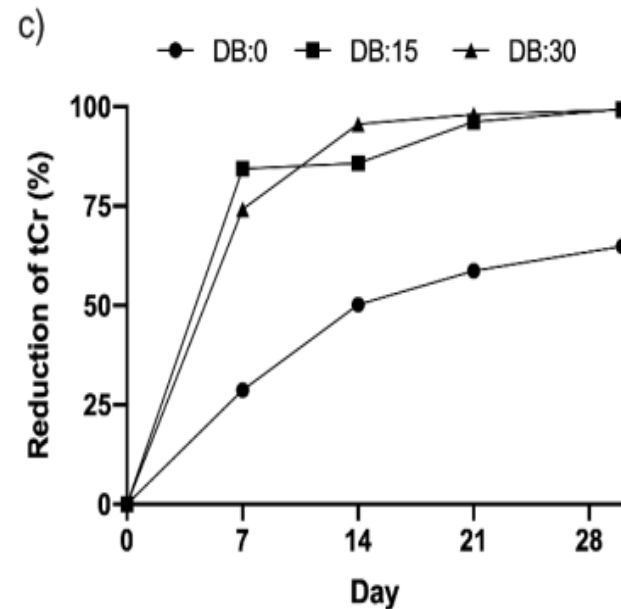
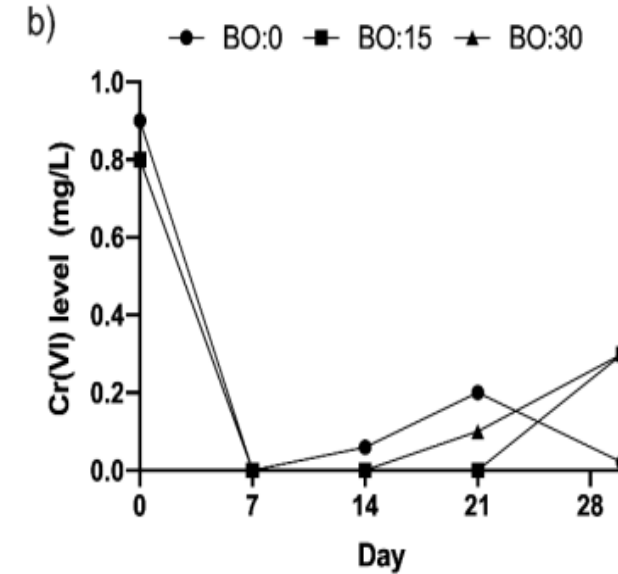
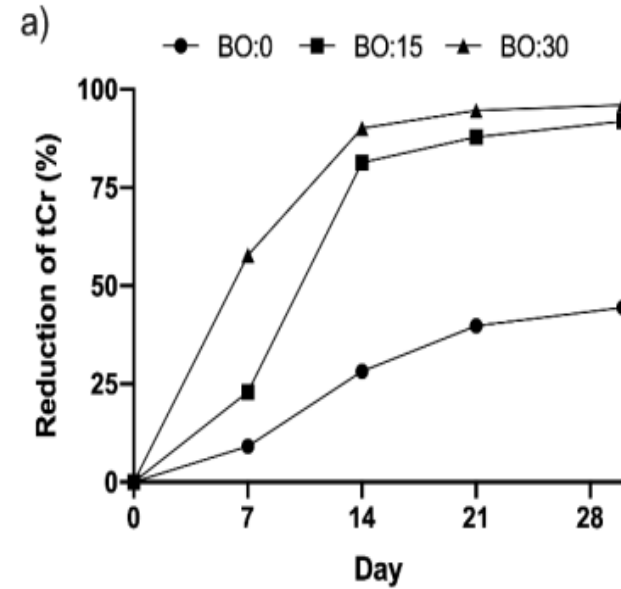
1. Chromium reduction efficiency

99% CrT reduction by the 21st day

Control - less than 60% reduction after 30 days.

Cr (VI) dropped in all BO, DB control and DB₁₅ to 0 by 7th Day.

However, 15 and 30 g donkey dung supplementation - exponential increase of Cr (VI) while total Cr decreases by day 30 in both bioreactors.



2. pH changes, CO₂ and CH₄ production

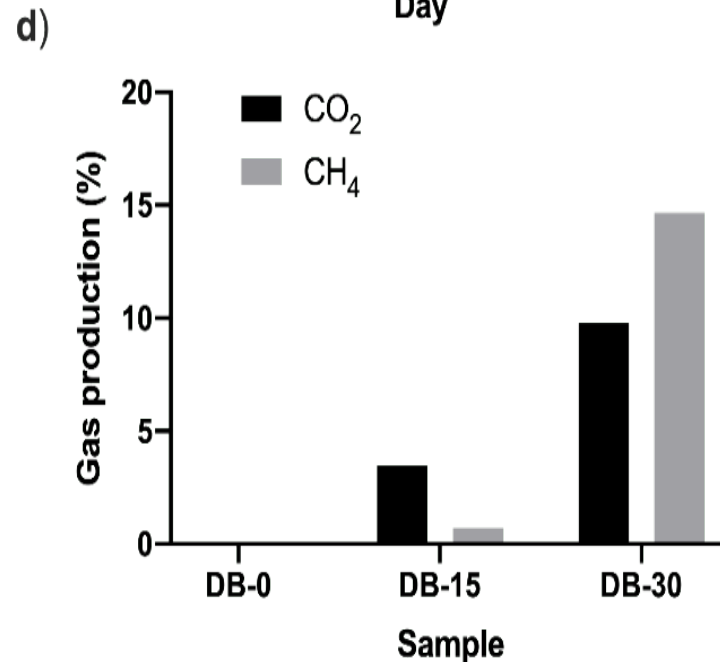
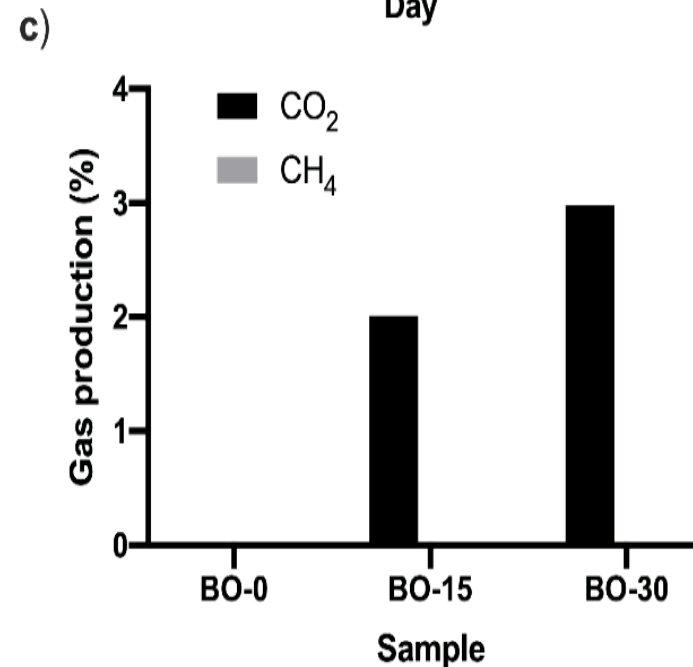
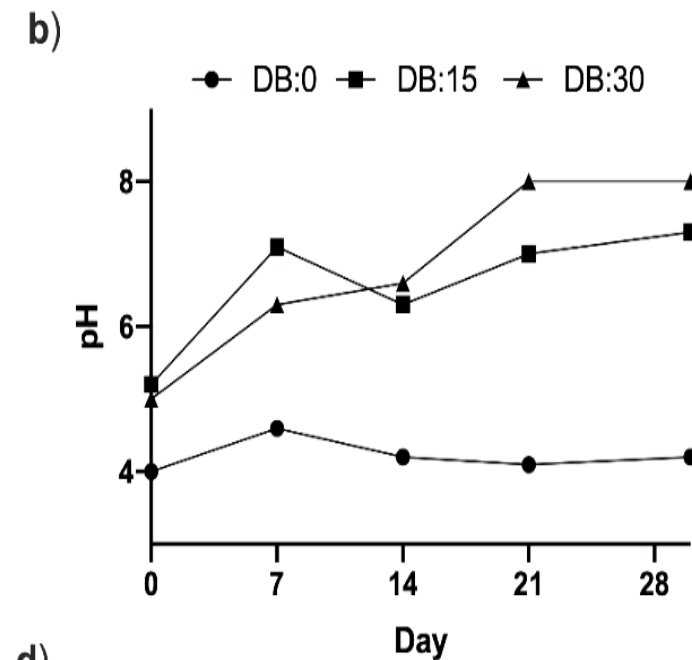
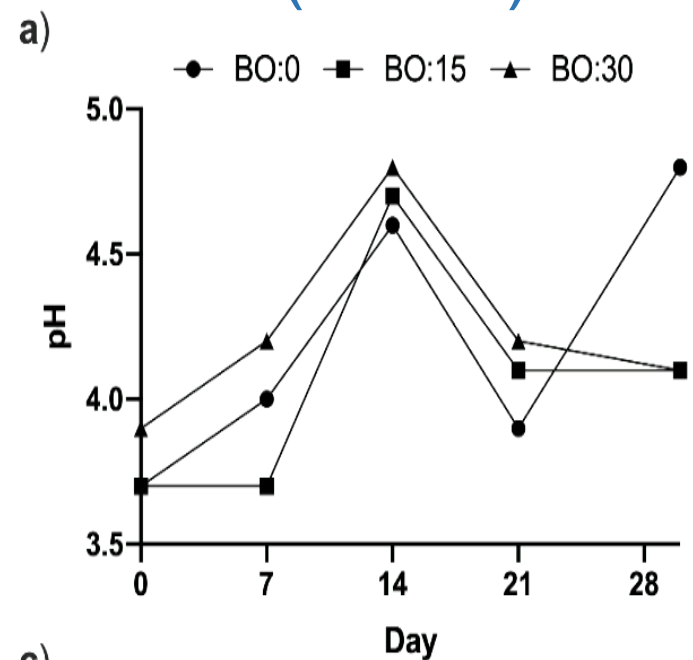
□BO - pH remained acidic (pH < 5.0)
DB - shifted from acidic (~pH 5.0) to mild alkaline conditions (pH 7.5-8.0).

□Control samples in both bioreactors were consistently acidic.

□BO + donkey dung - associated with CO₂ production.

□DB - higher CH₄;CO₂ production at higher donkey dung supplementation than in lower supplementation.

Result (cont'd)



Discussion (cont'd)

- ❑ This study found, that the **best optimum parameters** for chromium reduction in terms of hydraulic time, pH and organic load were between **7 - 14 days, acidic pH (3.8- 5.0) and organic load of 15 g.**
- ❑ Those parameters help **reduce total chromium** and **suppress the formation of Cr (VI) and other obnoxious gases** as microbes proliferated and **competed for the scarce substrates** contributing to Cr reduction (Siddique *et al.*, 2005; Ijoma and Tekere, 2016; Stahl and Christensen, 1992). These optimum conditions requires further research.

Contribution to knowledge

- ❑ Donkey dung in presence in tannery waste microbiome was fully characterised up-to the species level and it's dung used for the bioremediation of tannery based total chromium and Cr (VI)
- ❑ Characterised the anaerobic bacteria resident in donkey dung and tannery effluent using metagenomic approach in SSA.
- ❑ Demonstrated the potential of anaerobic bacteria resident in donkey dung and tannery effluent to reduce the high levels of total tannery chromium effluents and generate biogas in SSA.