

# Production of aquatic worms, for sustainable fishmeal replacement

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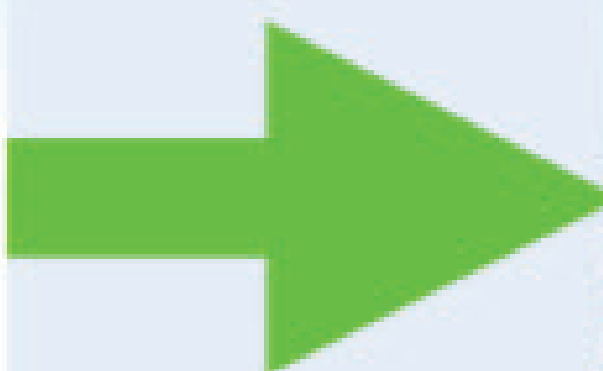
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## Valorization of food byproducts



Organic waste



Blackworm production



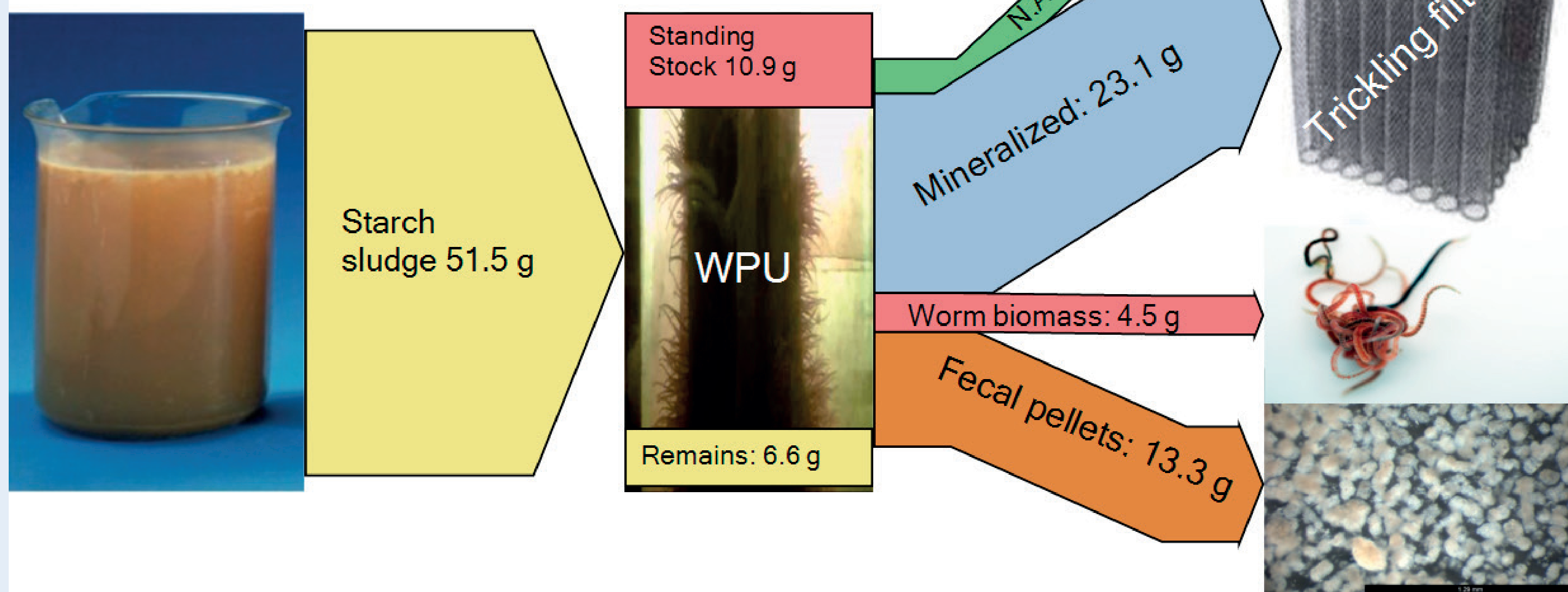
Fish farming

### Introduction

A tubular patented<sup>(1)</sup> worm reactor concept<sup>(2)</sup> was adapted to produce a high quality animal feed source by converting **safe food** industry byproducts into worm biomass. The freshwater worm *Lumbricus variegatus* (blackworm) was selected for this purpose. This cosmopolitan oligochaete is capable of reducing and concentrating bio solids like food residues or bacterial sludges and recover its nutrients. Its **macronutrient composition matches with fish nutritional guidelines**<sup>(3)</sup>.

### Research goal

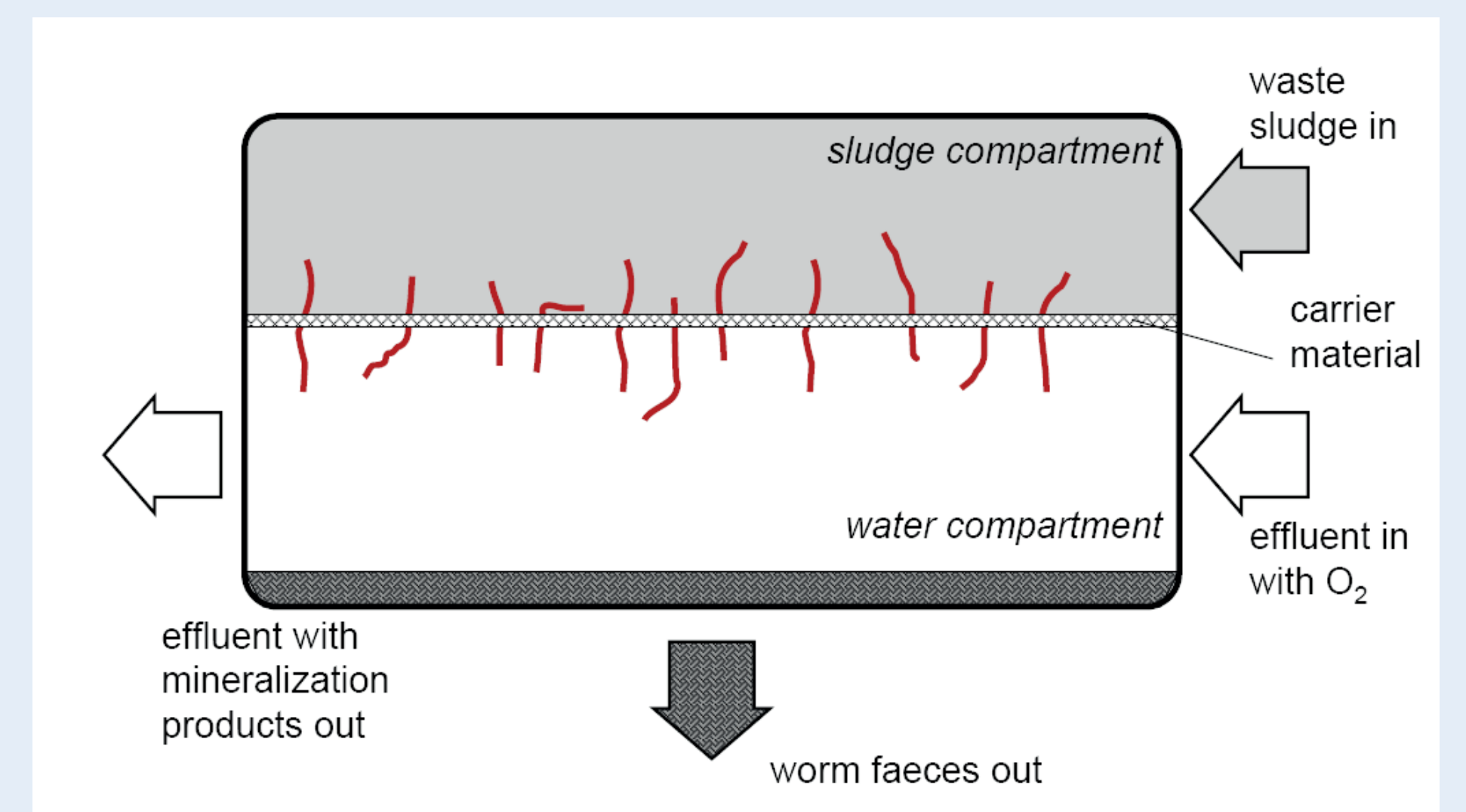
The present study was undertaken to study the conversion of real-life starch sludge into worm biomass using a novel worm production unit (WPU)



The performance of the worm reactor, mass flows for total COD. After 14 days

### Worm production unit

- Feeding worms directly with suspended bio solids
- Use of a Mesh column which acts as:
  - worm carrier
  - separation layer between worm-feed and water column.
- Feed particles, worms and fecal pellets can be separated and collected.



Scheme of reactor concept

### Results

- Worm recovery :
  - 8.7 % COD
  - 14.9 % Nitrogen
- Standing worm stock :
  - 0.96 kg ww/m<sup>2</sup> cylinder
  - Stable in worm number
  - Fluctuations in stock weight
- Similar recoveries in reactors with communal waste sludge<sup>(4)</sup>

### Discussion & Conclusion

- Bacterial breakdown should be reduced to increase worm production and nutrient recovery
- Improved food dosing essential for optimum recovery and worm production.
- Legalization important for commercial success

<sup>1</sup>Patent WO2007040397, <sup>2</sup>Elissen et al, 2010. Bioresource Technology 101: 804-811, <sup>3</sup>Mount et al, 2006. Environmental Toxicology & Chemistry 25 (10): 2760-2767, <sup>4</sup>Hendrickx et al. (2010). Journal of Hazardous Materials 177(1-3): 633-638