

From waste to wow – Low cost green technology for domestic wastewater treatment for reuse and beneficiation

MARONEL STEYN^{1*}, PAUL OBERHOLSTER¹, BETTINA GENTHE¹, and MELUSI THWALA²

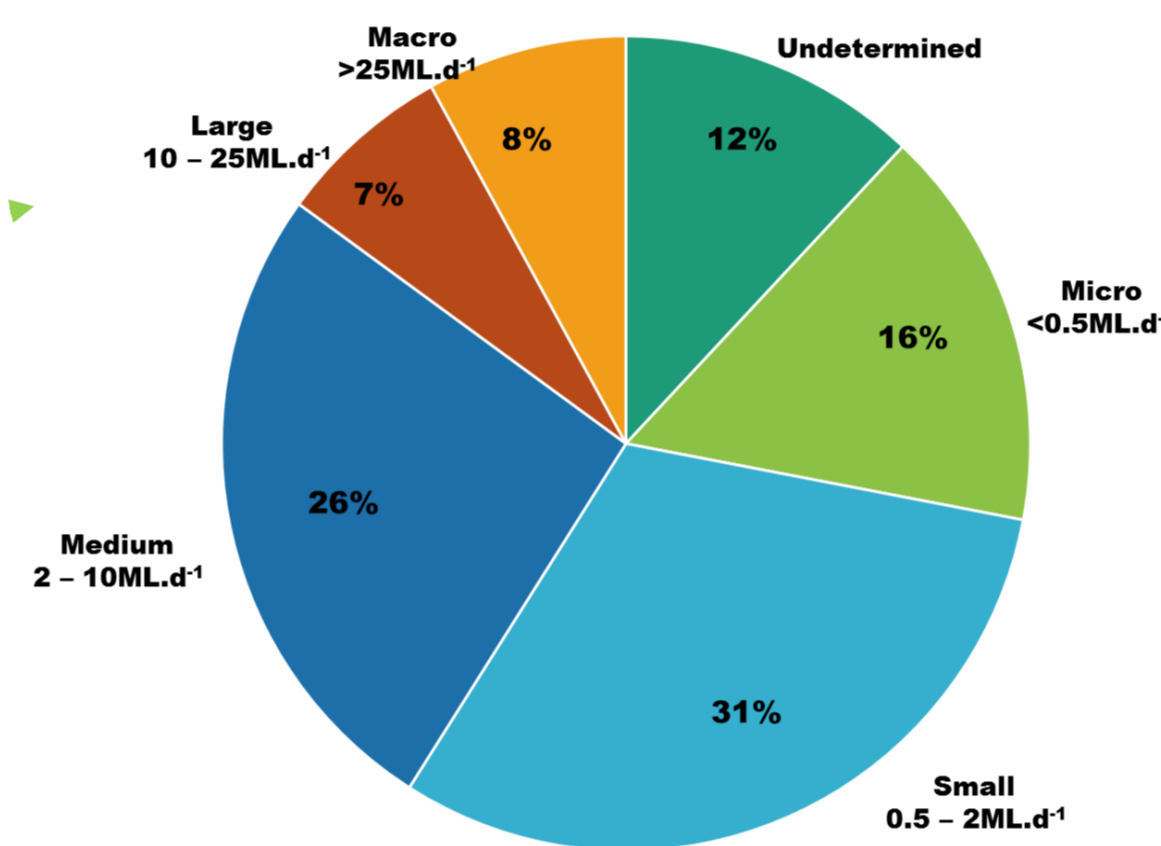
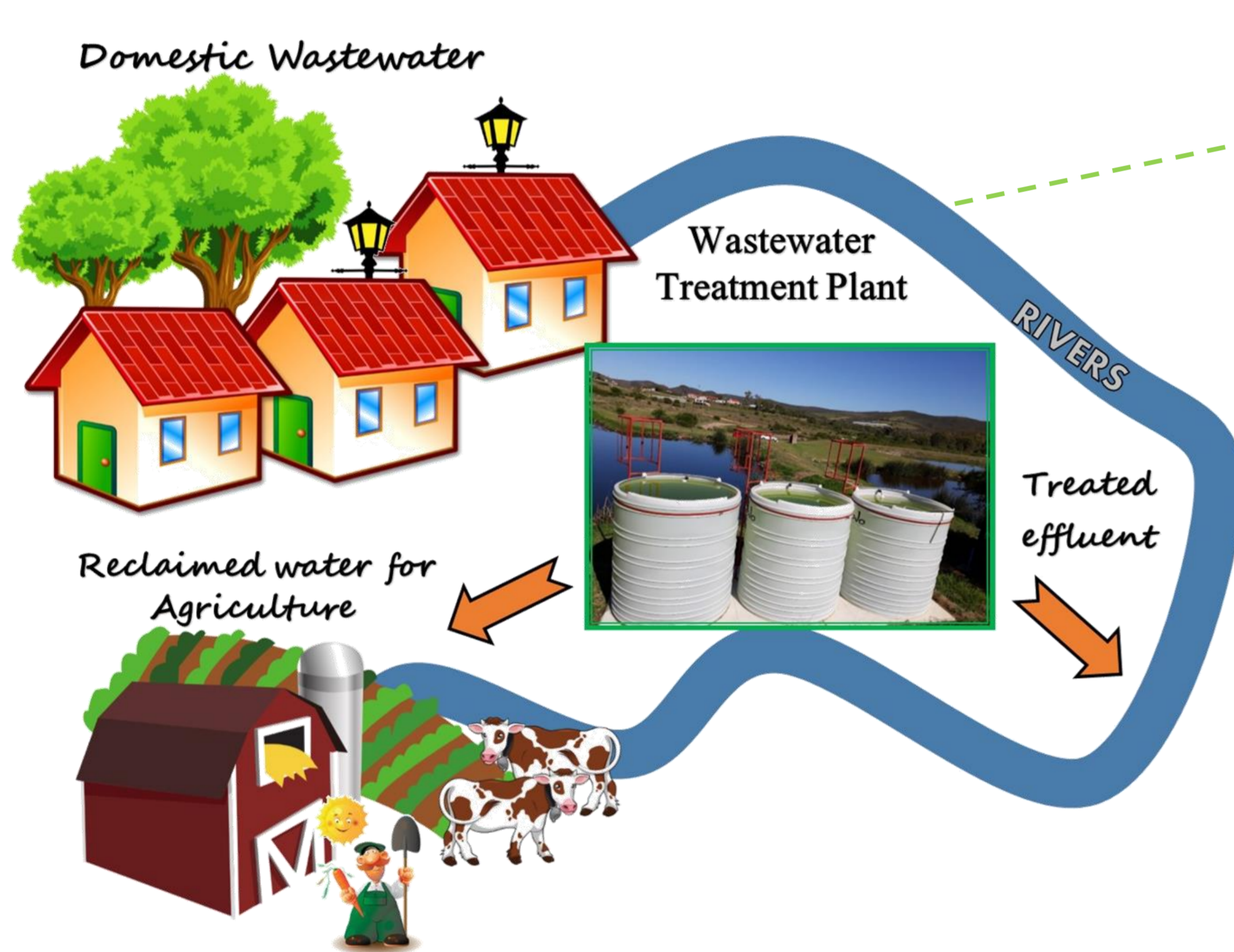
¹CSIR, Water Resources, PO Box 320, Stellenbosch, 7600

²CSIR, Water Resources, PO Box 395, Pretoria, 0001

*E-mail: msteyn@csir.co.za - www.csir.co.za

INTRODUCTION

More than 50% of the 812 wastewater treatment works in South Africa is dysfunctional. Rivers are often heavily impacted by treated and untreated wastewater discharge containing excessive pollution loads that can severely reduce water quality. Removal of excessive nutrients from these wastewater streams will improve the quality of our natural resources. Phycoremediation using a specific consortium of microalgae (*Chlorella* spp.) were implemented at two pilot studies in South Africa. It highlighted the feasibility of this technique to remove nutrients and improve the wastewater effluent quality under changing climatic conditions. Under auspices of the African Development Bank and the African Climate Technology Centre this research further investigated the possible value-added products that could be derived from the algal biomass generated during the treatment process.



Parameter	Removal efficiency after algal treatment
<i>E. coli</i>	5 log reduction
Total Nitrogen	56.3%
Total Phosphates	87.1%





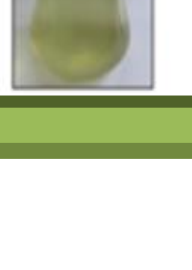
METHODOLOGY

- 1 Add 1 000 L water and 20g fertiliser to Jo-jo tank. Allow algae to grow and become more green (± 1 week).
- 2 Add 1 000 L water and 20g fertiliser to Jo-jo tank. Allow algae to grow and become more green (± 1 week).
- 3 Add 1 000 L water and 20g fertiliser to Jo-jo tank. Allow algae to grow and become more green (± 1 week).
- 4 Add 1 000 L water and 20g fertiliser to Jo-jo tank. Allow algae to grow and become more green (± 1 week).

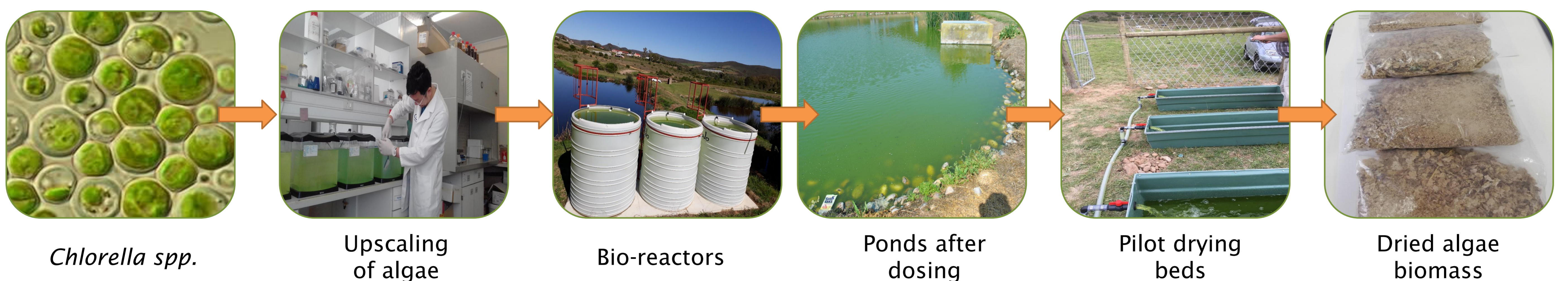
Release 4000 L of cultured algae into selected ponds.

When are the algae the right colour?

Use colour codes described below

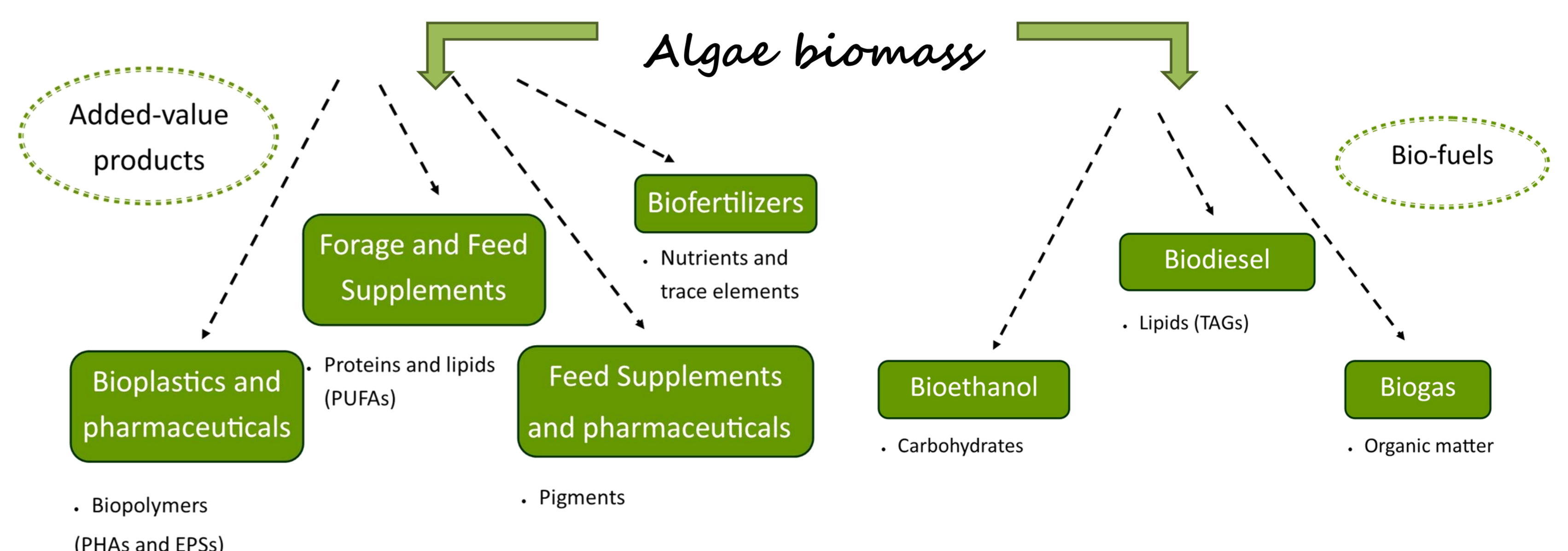
		A transparent colour indicates that algae have not started to grow yet.
		A light green colour indicates that algae are starting to grow.
		A medium green colour indicates that algae are growing well.
		A dark / rich green colour indicates that algae have reached maximum growth. Please dose ponds now.
		Yellowish / brownish colour indicates that algae are starting to die off. They need nutrients. Add fertilizer.

PILOT PROCESS



RESULTS

Neutraceuticals	Use/ Market	Concentrations in dried algae mg/250L
Lutein	Anti-ageing, eye health	752.79
Beta-carotene	Health-foods, supplements, colorant	145.21
Potassium	Bio-fertiliser	1967.66
Palmitoleic acid	Weightloss	27.57



CONCLUSIONS and RECOMMENDATIONS

This low cost, self sustaining system was very effective in South Africa and proved to be a feasible adaptation measure for different climates. Feasibility of this method should be tested in more African countries and is being investigated. Phycoremediation efficiently removed nutrients (nitrates and phosphates) and improved final effluent to within national reuse guidelines (special limits for irrigation). An average 5 log reduction in *E. coli* / mL was recorded over the two years. Algal drying beds should be upscaled to produce larger volumes of algal biomass for possible bio-fertiliser production.