

Removal of the green algae *Chlamydomonas* sp. with ultrasound, Pulsar 4400 equipment.

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The removal of green algae with ultrasound has been tested using *Chlamydomonas*, a single-celled flagellate genus used as a "model organism" in various fields of biology, especially in studies of molecular algae, flagellar mobility, chloroplast dynamics, biogenesis, and genetics, due to unique morphological characteristics and ease of cultivation and rapid growth.

Taxonomic classification

Empire:	Eukaryota
Kingdom:	Plantae
Sukingdom:	Viridiplantae
Infraqueo:	Filophyta infrakingdom
Phylum:	Chlorophyta
Subphylum:	Chlorophytin
Tuition:	Chlorophyceae
Order:	Chlamydomonadasles
Family:	Chlamydomonadaceae
Genus:	Chlamydomonas

Characteristics

Chlamydomonas has a more or less spherical shape, with a size <10 μ m, it has two anterior flagella that it uses to move. The cell wall is a glycoprotein, has a single chloroplast (organelle responsible for photosynthesis), reproduces asexually and sexually depending on the circumstances in which it is found, and presents ion channels directly activated by light, such as channelrhodopsin.



Test

A plastic pool with a diameter of 3.5 m and a depth of 75 cm was placed. The pool was inoculated with green algae from a sample from an irrigation pond in northern Chile. It was filled with washing machine drain water containing soap high in phosphorus and kept for 13 days.

5 water samples were taken to analyze the taxonomic composition and abundance of microalgae in the pool.

Results

As shown in Figure 1, after 13 days of ultrasound treatment, the dominant algae of the genus *Chlamydomonas* decreased in abundance resulting in a change in water color.



Figure 1. Removal of Chlamydomonas with the Pulsar 4400 equipment.

Chlamydomonas decreased abundance by 99% from 363,750 Cel/ml to 2,582 Cel/ml (Figure 2).





Figure 2. Abundance of Chlamydomonas.

Figure 3 shows the change of *Chlamydomonas cells*, apparently, the internal structure of the cell was impacted. In photographs a. and c., the chloroplast of the cells can be observed, while in photographs b. and d. there is no evidence of any intracellular organelle. It is necessary to take some photographs with the electron and confocal microscope to be able to evidence the above.



Figure 3. a. b. Cells without ultrasound treatment. c. d. cells after treatment with the Pulsar 4400.

During the test, the presence of 6 species was evidenced; 4 green algae (Chloropyceae), one diatom (Bacillariophyceae) and one cryptomonas (Cryptophyceae) (Table 1).



Table 1. Abundance of species during the test.

KINGDOM	FILO	CLASS	ORDER	FAMILY	GENUS	SPECIES	0	2	6	13
							Cel/mL	Cel/mL	Cel/mL	Cel/mL
Plantae	Chlorophyta	Chlorophyceae	Chlamydomonadales	Chlamydomonadales	Chlamydomonas	Chlamydomonas sp.	363,750	198,750	177,500	2,582
			Sphaeropleales	Scenedesmaceae	Desmodesmus	Desmodesmus communis (E. Hegewald) E.				
						Hegewald	6,250		26,875	26,219
					Scenedesmus	Scenedesmus acuminatus (Lagerheim) Chodat		2,500	5,000	3,055
						Scenedesmus cf. ecornis			6,250	3,782
Chromista	Bacillariophyta	Bacillariophyceae	Naviculales	Naviculaceae	Navicula	Navicula spp.	625	625	11,875	23,165
	Cryptista	Cryptophyceae	Pvrenomonadales	Geminigeraceae	Plagioselmis	Plagioselmis lacustris (Pascher & Ruttner)	68,750	12,500	1.250	909

As the abundance of green algae decreased, diatoms increased in abundance, dominating the community.



Figure 4. Abundance of green algae (Chloropyceae) and diatoms (Bacillariophyceae) during the test.

A secondary and unplanned outcome was the observation of mosquito larvae that were not affected by the ultrasound waves. The larvae were observed in large numbers and at different stages of development as shown in Figure 5.





Figure 5. Mosquito larvae near the Pulsar 4400 and in three different stages of development.