*Scientific Pre-Publication by Soley Institute*

# Maximizing Areal Productivity, Light Penetration Capacity, Photosynthetic Efficiency While Preventing Overheating of Dense Micro Algae Cultures by Chlorophyll Reduction Method

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## Abstract

It has been very important for the human kind to find new ways to produce energy and food from renewable resources since several decades due to environmental problems. Micro algae are accepted as one of the ways to roll back the process for a world, on which there is no hunger, no global warming, no petroleum wars, etc. Recently, growing micro algae has become common for various reasons. This paper reports an approach for using the same area size for min. 10 times more production while preventing also some problems during growing such as overheating or light penetration problems. Chlorophyll reduction method is claimed to be used in the future for more productivity values on a smaller area size.

(In this brief paper, spirulina platensis (M2 form) is used for chlorophyll reduction method. After patent application period and actual publishing, more micro algae species will be mentioned. Also methods and materials will be published after this process)

## Keywords

Micro algae, spirulina, chlorophyll, chlorophyll reduction, overheating, light penetration, areal productivity, dense culture,

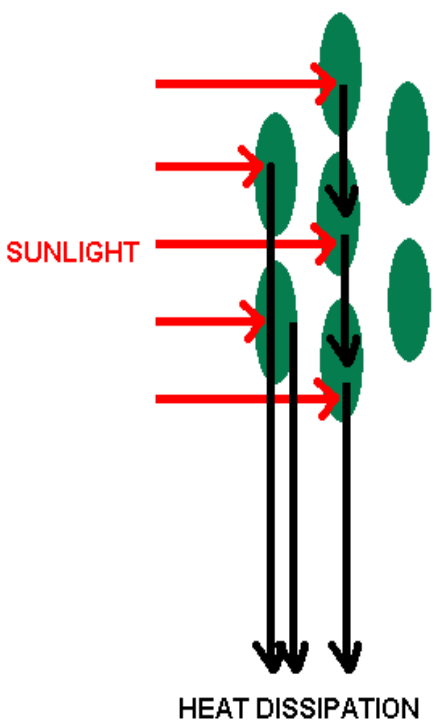
## Introduction

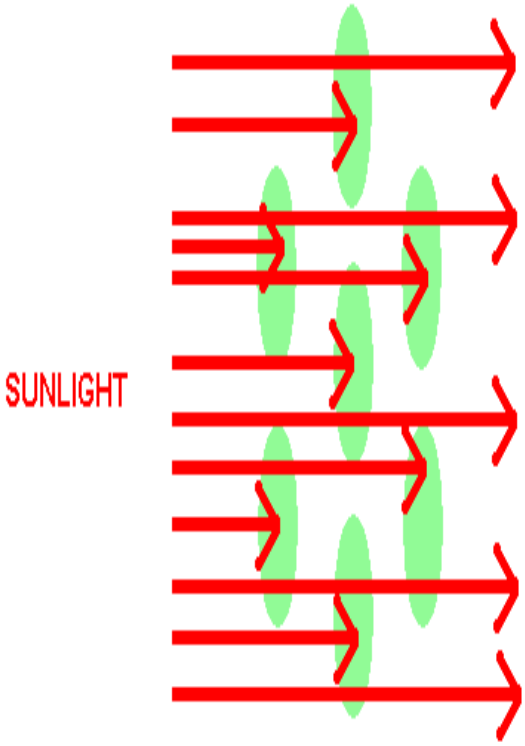
Until today micro algae ponds such as spirulina ponds and other related micro algae growing technologies have always had the light penetration and overheating problems. Due to the high concentration of the micro algae in dense cultures, solar energy can not penetrate more than 10-20 cm.

It is also known that some micro algae need dark and light zone cycles to be more productive. These cycles are needed in the photosynthetic processes for the micro algae to reset itself after capturing photons.

Because of these reasons explained above, most of the pond designs are having 40-50 cm depths. It is not possible to work with dense cultures in these kinds of systems. Overheating occurs also because of the dark color of the ponds, reducing production.

Use of dense cultures for chlorophyll reduced micro algae brings lots of advantages such as, more production during same doubling time, deeper light penetration and utilization, overheating prevention, higher land usage efficiency.




Normal Spirulina Culture

Chlorophyll Reduced Spirulina Culture

## Materials and Methods

(Complete part will be published after patent applications)

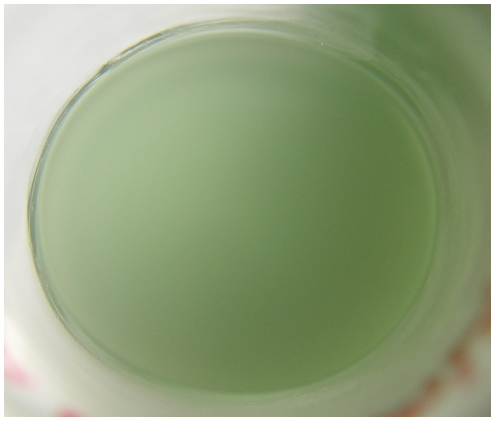
### *Example;*

10mx5mx0,4m(depth) pond is used for demonstrating normal pond production. In 20 m3 volume 16 kg spirulina is produced.

10mx5mx5m(depth) pond is used for demonstrating chlorophyll reduced spirulina pond production. In 250 m3 volume 190 kg chlorophyll reduced spirulina is produced.

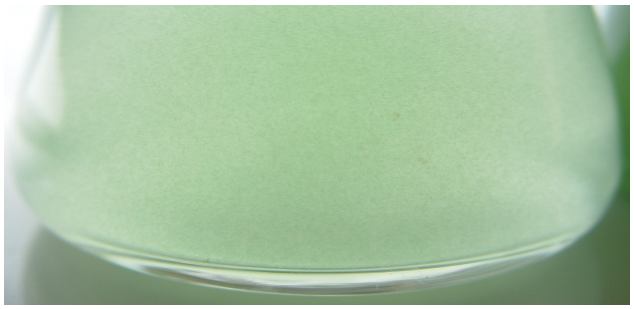
This is an evidence of producing on the same land area more than 10 times more microalgae.

Normal Spirulina Culture



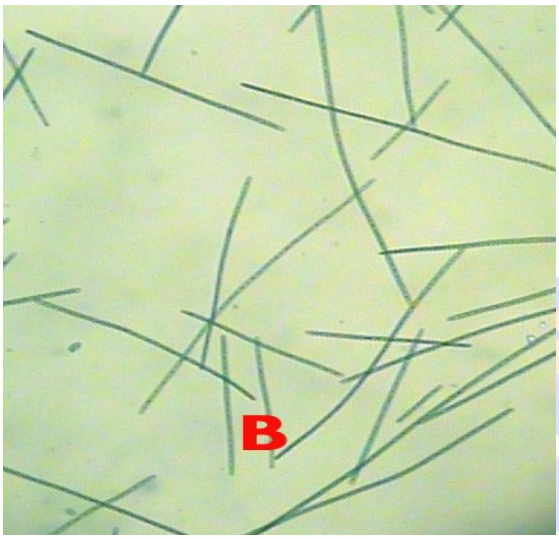
Chlorophyll Reduced Spirulina Culture

Normal Spirulina Culture

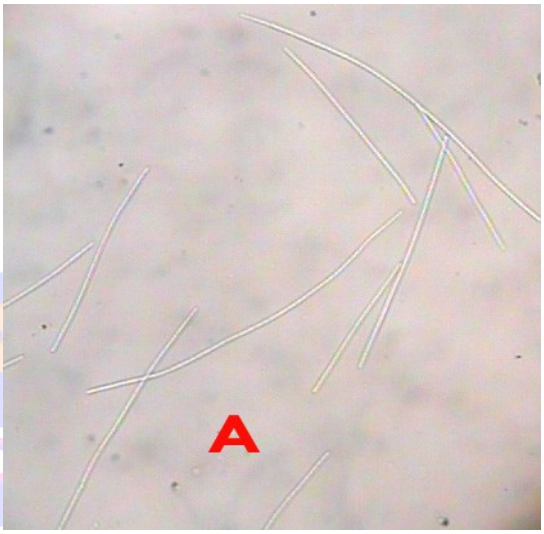


Chlorophyll Reduced Spirulina Culture

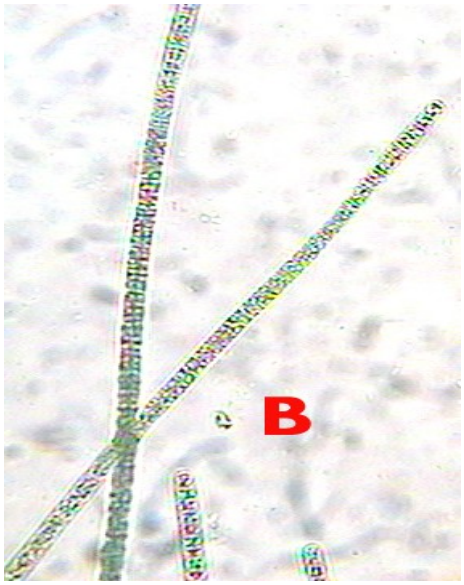
The photos above are made in the same environment, with the same settings. Both cultures also have same cell count in the same size of glass cup.




Normal Spirulina Culture




Chlorophyll Reduced Spirulina Culture




Normal Spirulina Culture

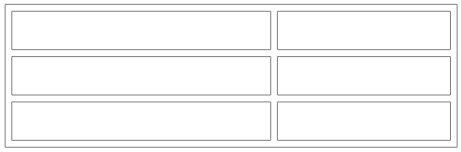

Chlorophyll Reduced Spirulina Culture

## Results

We have observed in our researches that deeper ponds could be used for dense cultures with partial chlorophyll reduction method. This allows us to use deeper ponds while maintaining production values and use the same land size for higher productivities. It is possible to make the pond depth at least 10 times more while using dense cultures.

Although nutritional value of chlorophyll reduced micro algae slightly changes (Table 1), this change is accepted as a minor effect considering higher and more efficient production values. The advantage of using chlorophyll reduction method increases the production by at least 10 times, which leaves all the other issues far behind.

Composition of Normal Spirulina



Composition of Chlorophyll Reduced Spirulina

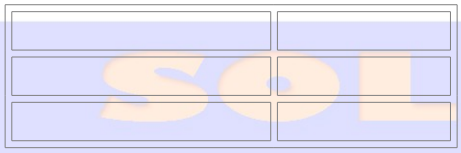


Table 1



As it could be clearly understood from the table 1, total protein is 4% decreased, total carbohydrate is 1% increased and total lipid is 3% increased in 50% partial chlorophyll reduced spirulina.

This partial chlorophyll reduction increased light penetration by 200% and decreased solar overheating by 50%.

In addition, culture productivity decreased 4% but on the same size of land area, it became possible to produce at least 10 times more using solar energy more efficient and using deeper ponds.

## Conclusion

Using the same area size for min. 10 times more production than normal pond productions while preventing also some problems during growing like overheating or light penetration has been successfully demonstrated. Chlorophyll reduction method is claimed to be used in the future for more productivity values on a smaller area size. This method could be also used for solving some problems about micro algae growing for mass productions.