



Review Article

STRUCTURED WATER: AN EXCITING NEW FIELD IN WATER SCIENCE

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Abstract: It has been reported that water at the interface of a hydrophilic thin film forms an exclusion zone, which has a higher density than ordinary water. The structured water or fourth phase water has a molecular structure that is arranged in a liquid crystal. This structured water appears to have a stimulative effect on plant growth. Structured water is being used in agriculture, dairy, poultry, medicine and construction industries with unbelievable benefits. There was both qualitative and quantitative yield improvement. Structured water did not contain energetic toxins, bring forward high oxygenation states, increases energy along with regulates and balances the soil minerals at the same time exhibits anti oxidant properties.

Keywords: Exclusion zone, hydrophilic, liquid crystal, structured water

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Introduction

Agriculture is the largest sink for fresh water on this Planet. Therefore, the conservation of water on farm is of vital importance for sustainability and dealing with the effects of climate change such as droughts. The best possible way to get rid of the water stress is the usage of structured water features various studies observing the structure of water with Raman spectroscopy and infrared spectroscopy. In addition, there are a variety of methods to alter the structure of water without changing composition [1]. Unlike waters being used in many agricultural applications, structured water:

- 1) Contains no energetic toxins
- 2) Brings forward high oxygenation states
- 3) Increases the energy
- 4) Regulates and balances the soil minerals

A first look at the structure of water was happened almost a century ago. The tetrahedral modeling of hydrogen bond was initially suggested via X-Ray Analysis in 1938 and went through nearly eighty years of disbelief [2-4]. An absolute pioneer in the field of structured water is Prof. Gerald Pollack from the University of Washington, who termed the fourth phase of water. This is what he calls the fourth phase of water and is often referred to as structured water. Through Nuclear Magnetic Resonance (NMR) spectroscopy, it is able to see this hexagonal structure and there are scientific publications in research journals on this topic [5,6]. Ultimately, this greater hydration of cells walls may lead to greater yield in plants. So, the structured water is highly applicable in the field of agriculture.

An exciting new field in water science: Recently it was claimed that there is a fourth phase of water similar to a liquid crystal, in addition to the three phases of water: solid, liquid, and gas [7]. This fourth phase takes place at the interface of hydrophilic material .as water molecules are arranged along the polarity of the surface. Since its density is higher than ordinary water, microspheres in a suspension are excluded as the water is structured, and, based on this phenomenon; it was named as an exclusion zone [8-10]. Also, electric potential as high as -200 mV has been observed to develop across the boundary of the exclusion zone and outside of this region (exclusion zone negative). This potential is generated by the dissociation of water molecules into negative ions (OH⁻) and protons as it is structured.

This important finding implies that water itself can affect the growth and bioactivity of live beings. Structured water is a molecular arrangement of water molecules that exists when water is near hydrophilic (water loving) surfaces. Much like ice, water molecules join together in hexagonally structured single layer sheets. As the hexagonal layers grow, protons are ejected into the nearby water.

Conversion of ordinary water to structured water

Ordinary water can be converted in to structured water by one of the following methods,

By running it through or over some obstructions, such as smooth pebbles creating eddies/vortex

Put water container in proximity of the magnet.

By swirling the water in a container

By clamping magnets on to the pipes conducting water (it can be used in drip or sprinkler irrigation) [10].

Properties of Structured water

1. It inhibits deposition/incrustation of dissolved substances, the phenomenon is not understood, yet it has useful application in saving boilers and connecting pipes from incrustation and choking.
2. It has slightly concave meniscus.
3. It is having low surface tension and greater wetting property.
4. Its pH is slightly above 7, which enables it to be assimilated in body fluids.
5. It neutralizes the acidic chlorine effect.
6. Structured water breaks clumps of water molecules and strengthens hydrogen bondage.

Benefits of structured water in the field of Agriculture

1. Soil health will improve and become more capable of supporting plant growth.
2. Soil will become more efficient in the delivery of nutrients to plants
3. Plants will become more capable of absorbing nutrients from the soil
4. The water holding capacity of soil will increase and after 1-3 months, the water needed for irrigation will gradually reduce (20-50 %), it can get economical as well as environmental benefit.

5. Crops will turn out healthier and will stay fresher for longer time.
 6. The stems of the flowers and plants will become stronger and thicker; sometimes double the size and strength.
 7. The quality and quantity of crops will dramatically increase.
 8. Leaves and flowers will grow in more vibrant colors and trees will respond very well to structured water by growing faster and stronger.
 Structured water exhibit antioxidant properties and appears to exhibit the same properties as an antioxidant, since no antioxidant components were added in the water. He concluded that the water can play an essential role in bioactivities of cells, depending on its antioxidant effects, based on its structure. Water itself can be an active constituent in cell biology, as are many other cellular molecules [11].
 The structured water has been found to be increased crop yield e.g. winter wheat (28 %), corn (17 %), cucumber (32 %) and tomato (32 %). It increases milk production and fertility in cattle, meat and egg production in poultry. It results both qualitative and quantitative yield improvement [12]. The effect of using structured water during higher temperature (340C) has an significant impact on speed of germination (83.18) against natural water (75.93). Fresh seeds at 28 0C when structured water was used has recorded higher first count (61 %) followed by 340C (61 %). Seeds treated with structured water have recorded higher germination percent (89 %) compared to normal water (86%). Fresh seed lots treated with structured water maintained at 28 0C has recorded higher germination per cent of 97 on par with old seed lot at 28 0C (96%). Similarly, seedling length of 13.31 cm was recorded in structured water compared to normal water (12.81 cm). They concluded that structured water enhances the performance of aged seeds under heat stress in tomato [13].

Conclusion

Structured water is still in this progression and needs more scientific inquiry. While still moving slowly in academic research, structured water is already breaking through on the commercial level.

Application of review: It is a review article which provides valuable information on structured water and its various applications and these in turn can be used for proposing research experiments.

Abbreviations:

0C : Degree Celcius
 % : Per Cent
 cm : Centimetre
 mV : Milli Volt
 NMR : Nuclear Magnetic Resonance
 OH- : Hydroxyl

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