

## **Chiral amplification due to rotation of water molecules in spiral alignment at the membrane of the bubble**

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**[Observation of the phenomena caused by behavior of spiral structure in the water]** Followings were confirmed by slow motion replay of movie photographed at 30 frames per second [1]. 1) Rising bubble of carbon dioxide in carbonated water outputs white area from the bottom, concurrently sudden move of bubble takes place. 2) The sudden whitening of water in carbonated water was generated at coalesce of bubbles. 3) The white area of water in carbonated water behaves as if it prevents from separation of carbon dioxide bubbles. Whitening of water is caused by existence of carbon dioxide.

**[Understanding on whitening of carbonated water]** Water molecules is tetrahedral by hydrogen bonding. A unit molecule is configured with an oxygen atom and a pair of hydrogen atoms. The spiral structure shrinks by alternated rotation of molecules. Energy of  $\alpha$ -quartz structured water is the lowest. And it condenses the volume and connects bubbles. Most of molecules of carbon dioxide ( $\text{CO}_2$ ) are placed at through hole of the spiral structure. Here, electric polarization of  $\text{H}_2\text{O}$  is aligned along 120-degree directional electric axis of water. The spiral structure is formed at vertical direction to the plane.

**[Thermal vibration of respiration type in helical arrangement of water molecules]** There is the rotational thermal vibration where each water molecule turns alternately along electric axes. The rotation angle accompanies with a slight shrinkage. So, thermal vibration of water molecule is torsional along alternating electrical axis. It accompanies with motion of breathing. A pair of hydrogen atoms of water molecule faces out to through-hole of spiral structure.

### **[Transport of $\text{CO}_2$ that was trapped inside of a spiral structure]**

In case of transport of  $\text{CO}_2$  along through-hole of spiral structure, vibrational thermal motion of water molecule turns to one directional rotation. So, instantaneous whitening of the water around the bubbles is observed accompanying with the quick movement.

**[Synthesis of filamentous polymers via rotation of water molecules at vicinity of membrane]** When powder of iron (Fe) is mixed with carbonated water, bubbles of  $\text{CO}_2$  are formed. Those bubble rise to surface of water. Fine iron powders attach to membrane of the bubble and those were oxidized. The oxide drops down to the bottom of water. Concentration of positive ions in bubble becomes high via oxidation of the iron atoms at membrane of bubble. The difference of concentration cause transportation of the molecules. These structure works as a waterwheel by transportation of molecules through through-hole of spiral structure. So, chiral amplification is realized by this type of movement on spiral structure of water. The systematic motion of molecules in liquid water motions are essential to creature.

### **[References]**

[1] S. Karasawa, "The formation of spiral structure and occurrence of rotation of the spiral structure in liquid water", [ <https://www.youtube.com/watch?v=KRvJ5cCIDk> ], 2016/07/28