Tourmaline

The main component of **Classwash Ball** refills is from tourmaline. Below are briefly described the physical and chemical properties of these minerals.

Generality

Tourmaline are minerals associated with igneous rocks and metamorphic ones. Tourmaline is formed by a complex group of mineral silicates that shares an identical crystal structure (trigonal) and a different chemical composition. The main components of tourmaline are the boron silicates and aluminium silicate, but because of isomorphism (the solution of an ion with another in the crystal net without changing the mineral structure), have been incorporated in it other minerals, especially sodium, calcium, iron, magnesium and lithium.
Differences in chemical composition are due to both differences in colour and chemical-physical property. Because the detergent capacity of tourmaline is never questioned, it holds forth on the chemical and physical mechanisms that give the tourmaline this property.

Physical and chemical properties

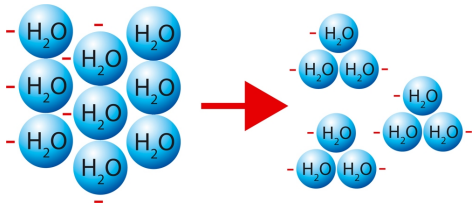
Tourmaline as a consequence of their crystalline asymmetric structure and the presence of boron atoms, which has an external electronic structure with an electronic gap, have two characteristic properties, the piezoelectricity and the piroelectricity.
Piezoelectricity is the electric polarization that is obtained in certain dielectric crystals as a result of a mechanical stress (ie lighter). It is also, on the contrary, the mechanical distortion of the two faces of a crystal after applying a given voltage between the faces.
Piroelectricity is the property of certain crystals that produce a state of electric polarity in response to a change in temperature.
These two properties are known long and well documented by an extensive international literature.
In tourmaline the thermal coefficient due to the polarization of the energy is 1x 10-7 + 4x10-6 cal•cm-2•k-1.
When changing the temperature and pressure (including micro changes n fractions of °C), they cause a potential difference (voltage). This type of static voltage is higher than 1 million electron volts (1x106 eV) and this accelerates the ionization of air and water surrounding the crystal.
The electrons emitted strike present water and oxygen molecules and turn them into negative ions (formally h302-e O32-), this means that there is an oscillating imbalance of polarity of the crystal which causes a change in orientation of the dipole: negative ions newly formed are forced to leave the surface of the crystal.

In 1986 a Japanese research centre showed that even when the tourmaline was turned into dust, in microcrystals remained positive and negative electrodes and these ones did not disappear even if the tourmaline was increased to about 1000 °C. Moreover, when the electrodes were connected to each other was recorded a current of 0,06 mA.
Subsequent studies have provided a check on the effects that mechanical agitation and temperature change have on tourmaline.

Tourmaline has positive and negative electrodes that generate an electromagnetic wave applied to water of 4 +14 μm (the energy corresponding is 0,004 watts/cm2). As a result, clusters of water are broken generating hydronic ions (H3O+) and hydroxyl ions (H3O2-). Agitation in water of tourmaline creates friction that increases the production of positive and negative ions. Elba tourmaline contained in the **Classwash Ball** is a basic tourmaline which mainly issues, naturally, hydroxyl ions (H3O2-).
A study by Matsuoka et Al. formulate correlated hypotheses that take into account the several aspects of piroelectricity of tourmaline and examined their possible consequences. Though not exhaustive, this study

provides answers that now mean that the tourmaline is used, with dozens of patents, for processes involving the detergent.

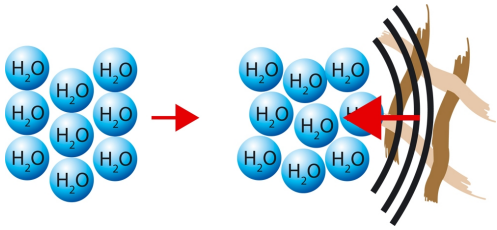
1. Increases the ability to dissolve water tourmaline atmospheric oxygen increased as the electric charges generated by the tourmaline lead to the overall reaction:
6(H2 O)+O2 + Oil → 8(H+)+4(OH-)+4(O=)+ Oil → 4(H2 O)+(4(OH-)+ Oil
The first arrow indicates the natural dissociation of the water, the second is a consequence of excess electric charges generated by the tourmaline for the oil binds to the OH-ions constantly shifting the balance towards right.



Dissociation of water's molecules

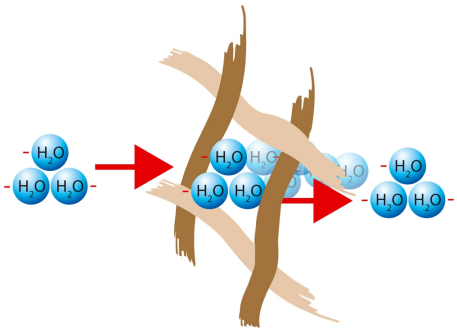
2. The simple dissociation of water. The electric charges generated by the tourmaline would have the overall reaction:
3(H2 O)+Oil → 2(H2 O)+(H+)+(OH-)+Oil → (H3 O+)+Oil+(H3 O2-) → (H3 O+ +Oil)+(H3 O2- +Oil)
The first arrow indicates the natural dissociation of water, the second is a consequence of excess electric charges generated by the tourmaline that push towards right the ions H3O+ and H3O2- that bind oil, constantly shifting equilibrium (cleansing).

3. Micro turbulence. Surface tension prevents water from entering the interstices of the fibre by preventing the removal of dirt. The turbulence of the water facilitates its penetration into tissues. Static electricity generated by the tourmaline water induces micro turbulence. The rapid back and forth movement of water, (pole + pole -) on a smaller scale than that formed by the drops generated by surface tension, allows water to penetrate tissue with the consequent removal of dirt.



Surface tension prevents water from penetrating into dry tissues

4. Direct electrostatic effect. Dirt has a surface that is covered also by electrostatic forces (depending on the nature of the dirt). It is likely that the forces generated by electric charges of the tourmaline exceed the electrostatic forces that hold together the particles of dirt breakdown.



Water's molecules, riduced from tourmaline, pass ten times more into tissues

5. Surface tension. The surface tension force is the force that prevents water from penetrating into tissues that are not pre-wet. Drops are formed as a result of surface tension and, under normal conditions, a capillary tube, at 20°C, in 4 seconds fall 58 drops of tap water (untreated) to form 1 ml. The presence of static electrical charges generated by tourmaline (a large quantity of ions hydronic (H3O+) and an excess of hydroxyl ions (H3O2-) means that in 1 ml, from the capillary, fall 1200 +1400 drops. Then drops have sizes that are approximately 1 / 20 of normal drops. Said differently, the surface tension of water res tourmaline is ten times less than that of tap water and the wetting effect and therefore cleaner, is ten times greater. Emulsifier action, for a mixture O/W, is a great increased result.

6. Permeability. Permeability is the ability of the water passing through a material that is pre-wet to remove the effects of surface tension. Matsuoka experiments have shown that linked the related to reduction of surface tension there is a concomitant increase in permeability, i.e. a reduced resistance to water flow through the tissues previously wet.

7. Very low energy activities. The weak energy emitted from tourmaline (4+14µm) can break down water (tap water on average is composed of clusters of 36 +38 water molecules, the water passed through tourmaline a 3 +6 water molecules. This allows gas or heavy metals included in the cluster to be released, making water substantially free from impurities. Result: can be used for washing special items and helps to remove detergent residue from the mesh fabrics.

8. Anti fungal and anti bacterial. Aluminium content in tourmaline has, together with the ionization of water, an anti fungal and anti bacterial properties.

9. Whitening. The ionizing effect of tourmaline enhances the whitening effect of any specific additives used in laundry.

10. Economy and environment. Unlike ordinary household cleaners the use of tourmaline is very cheap and does not cause environmental pollution. It is not necessary to rinse with an additional saving of water.

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