

EDITORIAL: HOW COPPER PRODUCTS WORK



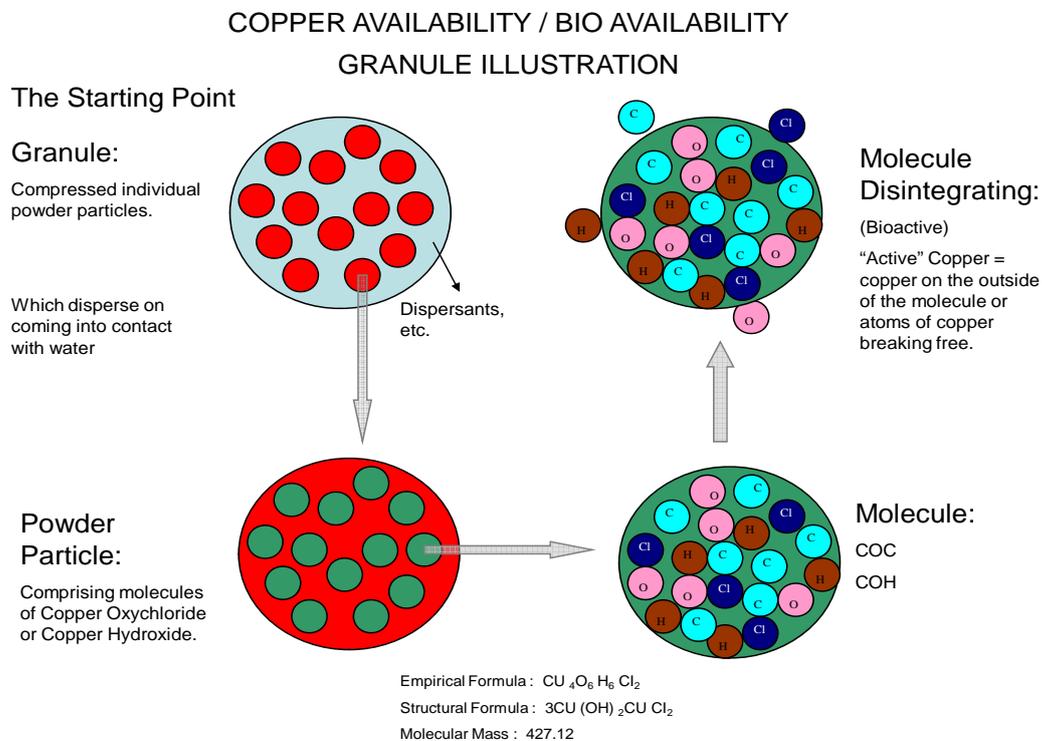
Introduction and formulation evolution:

Copper-based products have been in use as fungicides for over a hundred and fifty years, which demonstrates their reliability. The first copper-based formulations, were copper sulphate based and were used in large volumes. This is no longer the case due to product and formulation improvements.

The formulations and types have changed over the years. The biggest change being the compounds are more active, which in the practical sense translates to less copper (active ingredient) being applied to crops without compromising fungicidal activity.

There are two broad categories of copper-based products. Those, which are water soluble such as copper sulphate, and those, which are insoluble in water, such the oxychlorides (Coppox® WG) and hydroxides (Hydrocop® WG). Water-soluble formulations are short lived whereas the insoluble products release active copper ions over a period of time and are comparatively residual in nature.

The most advanced user-friendly formulations are the more concentrated water dispersible granules, which are also referred to as Dry Flowable Formulations. A granule is literally a compressed powder with additives, which ensure effective dispersion. Contact with water in the spray tank reverses the formulation to a powder and the process can be seen on the following illustration:



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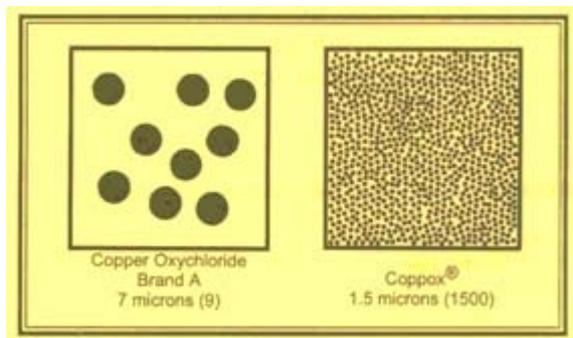
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Copper products – how do they work?

1. Particle Sizing

The smaller the particle size, the better the coverage on the plant surface. This is illustrated on the diagram below:



Coppox® WG has an average particle size of 1.42 microns. This has a direct effect on coverage, tenacity of the product and ultimate fungicidal activity and suspension in the spray tank.

This is **the** single most important factor in terms of fungicidal activity. Formulations containing say 1 micron vs. 2 microns, have a coverage factor of 10 times the number of particles and not twice the number of particles as one would first consider.

2. Copper Content

This is important, as copper is the active ingredient. Copper products have a range of copper contents, the majority are in the 15% to 50% active copper range.

Coppox® WG and Hydrocop® WG contains 500g/kg active copper (or 50% active).

The higher the concentrate the less the handling, which assists growers.

3. Cupric chloride levels

Cupric Chloride is found in most copper products, and – when present in high concentrations (1000ppm and above) – is responsible for the burning sometimes associated with such products.

The cupric chloride levels of Coppox® WG ranges between 8-25ppm, which has distinct benefits to crop safety.



4. Heavy metal impurities

There are a number of heavy metals that exist with copper in its natural state and therefore, can be a contaminant.

The quality of the copper used from the onset will determine the heavy metal impurities in the final product. There is a very wide range of raw material ranging from impure copper piping to high-grade wire at 99.9%.

All Melpat Copper Based Products are manufactured using high-grade copper and consequently the detectable levels of these undesirable heavy metals is below to non-existent. Lead for example would average 22ppm and recognising the legal limit being 250ppm, would be considered extremely low.

We have tested some different products available on the market, and have turned up interesting results. In one particular sample of a traded product, the lead level was 7200ppm, which is 25 times over the legal limit as set by the World Health Organisation. These products coat the fruit and vegetables we consume, and high levels of lead (and some other metals) are an environmental and human health hazard.

We encourage all growers to request specifications of any copper products they purchase, to ensure they are receiving a good quality product.

5. The manufacturing process of oxchlorides and hydroxides

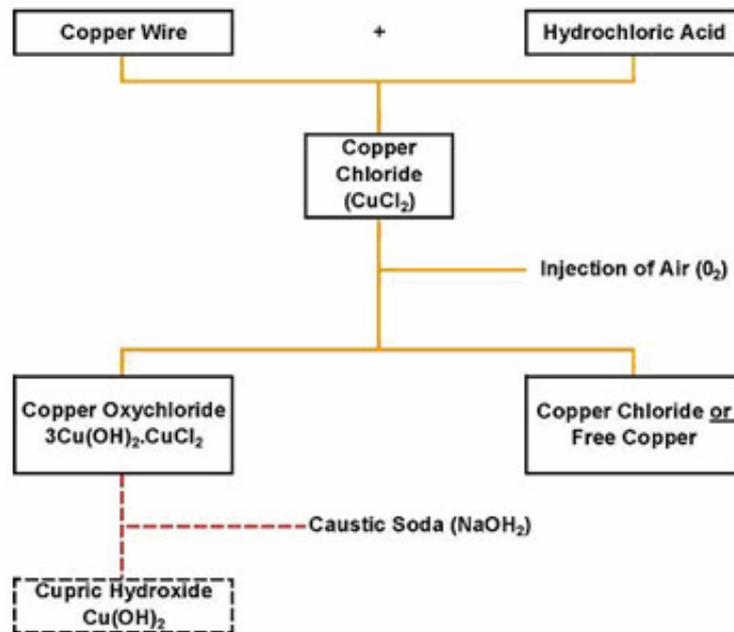
The manufacturing process for both hydroxides and oxchlorides has the same starting point. There is an additional production stage in the manufacturing of cupric hydroxide such as Hydrocop® WG.

In the case of hydroxides, this additional step results in additional cost. Hence, hydroxides will always be more expensive on a cost-per-kilogram active (copper) basis than oxchlorides.

Copper is reacted with hydrochloric acid. The reaction time determines the amount of copper chloride in the end product. The cupric chloride (impurity) is the "burning culprit" in copper-containing products, and an undesirable element as outlined in Item 3.



THE MANUFACTURING PROCESS OF COPPER-CONTAINING PRODUCTS



6. Soluble vs. Insoluble coppers

The fungicidal / bacterial properties of copper products are based on copper being slowly dissolved in moisture in the presence of weak organic acids on the plant leaf. This "breakdown" releases copper ions, which in turn act on the fungal spore.

The mode of action of all copper fungicides is by interfering with the enzyme system of spores and mycelium, a process that is usually irreversible. It forms a chemical barrier against attack.

These protectant fungicides, form a chemical barrier that protects the plant tissue from fungal attack. It does not have any systemic fungicidal value. As the plant grows the plant tissue expands leading to the distance between particles increasing.

For this reason, repeat applications of the protectant fungicide is necessary in order to protect new growth.

