

The Copper: A Holistic View between of a Polluting Cation and a Healthy Ingredient



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Mini Review

Facing to the increase demand of copper and the future uses, the environmental issues of this element should be considered. From computers to electric cars and from solar panels to wind energy the predicted impact to the global climatic preservation seems to be positive. As far as the mechanical and electric properties of the metal there is no doubt everything seems to be on the good way. Oxidation of the metallic copper produce copper cation, well known for his uses in agriculture and in human life. The raised question is: It is a polluting cation? Or is a pillar of healthy life.

Copper is an indispensable element for the living organisms in which perform specific metabolic functions. Because it is an essential element, daily dietary requirements have been recommended by the American Medical Association at 1.2-1.3mg/day. Copper cation is involved in the functions of many copper-dependent proteins, including transcriptional regulators, chaperones, oxidoreductases, mitochondrial electron transport and free radical scavenging [1]. Copper cation intakes have been declining and it appears that a large fraction of the population does not even consume the recommended daily allowance (RDA) for copper (0.9mg per day) let alone an optimal intake of copper (2.6mg per day). Thus, it appears that much of the population is at risk of inadequate but especially suboptimal intakes of copper [2].

In the USA, heart disease is the leading cause of death overall [3]. While research and medical practice has focused almost exclusively on cholesterol and dietary saturated fat as Ischemic Heart Disease risk factors, we may have overlooked an exceedingly simple, plausible and widespread condition, copper deficiency, as one cause, perhaps even a major cause. Avoidance of copper-rich foods may play a role in widespread copper insufficiency and deficiency and therefore may be linked to IHD via copper [1].

As it mentioned by DiNicolantonio [4] from the studies of Bugel et al. [5] healthy young women supplemented with 3 or 6mg of copper sulfate per day have a significant increase in superoxide dismutase activity in red blood cells and plasminogen activator inhibitor type 1 was significantly reduced.

Copper is used since three centuries as fungistatic and fungicide especially in grapes and stone fruits. Bordeaux mixture is an example of such application. Soils are overloaded in some cases with copper ions and old vine plants are plant-accumulators of copper. Despite of this soil contamination, wines and grapes does not accumulate much more copper cation than the permitted by the international studies and regulations.

Copper is an element and therefore cannot be degraded. In soil, copper is present in a number of forms partitioned between soil and solution. According to Commission Regulation 2015/232/EC, a review of European monitoring programs was provided and used to identify 'background levels' of copper present in soil from natural or anthropogenic sources other than the regulated use for the soil exposure assessments. Considering the representative uses 'background levels' were 160mg Cu/kg soil (90th percentile) for grape and 26mg Cu/kg soil (90th percentile) for tomatoes and cucurbits [6]. The wine industry is one of the most concerned about agricultural uses of copper, so we will be focus on that. We will be also focus on this because there is a worldwide increase in wine demand and new players have come into this production and consequently more and more surface on the planet are susceptible to receive copper ion as fungicide. (China, India, South America, Australia, New Zealand South Africa, etc.)

Some authors say that there are some agricultural techniques in the vineyard which include the use of copper compounds and can result in a higher level of copper residues in the grapes at harvest [7] although higher copper concentrations in the soil

result in an increase of the copper levels in berries [8]. In other research almost no changes in the copper concentrations were found in the grapes, must or the wine from plants with a higher concentration in their leaves due to the sprays applied during the vegetation season [9]. The final copper in the wines was not at levels harmful to human health. In Efsa report is mentioned that further considerations are needed [10].

The legislative values are generally country specific. For example, the Organization International de la Vine et du Vin's (OIV) compendium of international methods of analysis sets a maximum acceptable limit for Cu of 1mg/L in wine [11]. Considering that the recommended doses of wine is two glasses per day, a large portion of daily dietary requirements in copper can be acquired from the wine.

The French paradox [12] is a catchphrase [13], first used in the late 1980s, that summarizes the apparently paradoxical epidemiological observation that French people have a relatively low incidence of coronary heart disease while having a diet relatively rich in saturated fats. It is believed that one of the components of red wine potentially related to this effect is resveratrol [14]; however, the authors of a 2003 study concluded that the amount of resveratrol absorbed by drinkers of red wine is small enough that it is unlikely to explain the paradox [14].

As a typical French diet contains liver (liver paste), oysters, green salads and wine and all these foods and drinks are rich in copper, copper may be associated with this effect and not with polyphenols and other wine compounds. We need more epidemiological research around the world to have a more accurate picture of the true role of copper ions in the environment and in human life.

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