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# The use of activated carbons to remove heavy metals and *N*-(phosphonomethyl)glycine from European wines

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## 1. INTRODUCTION

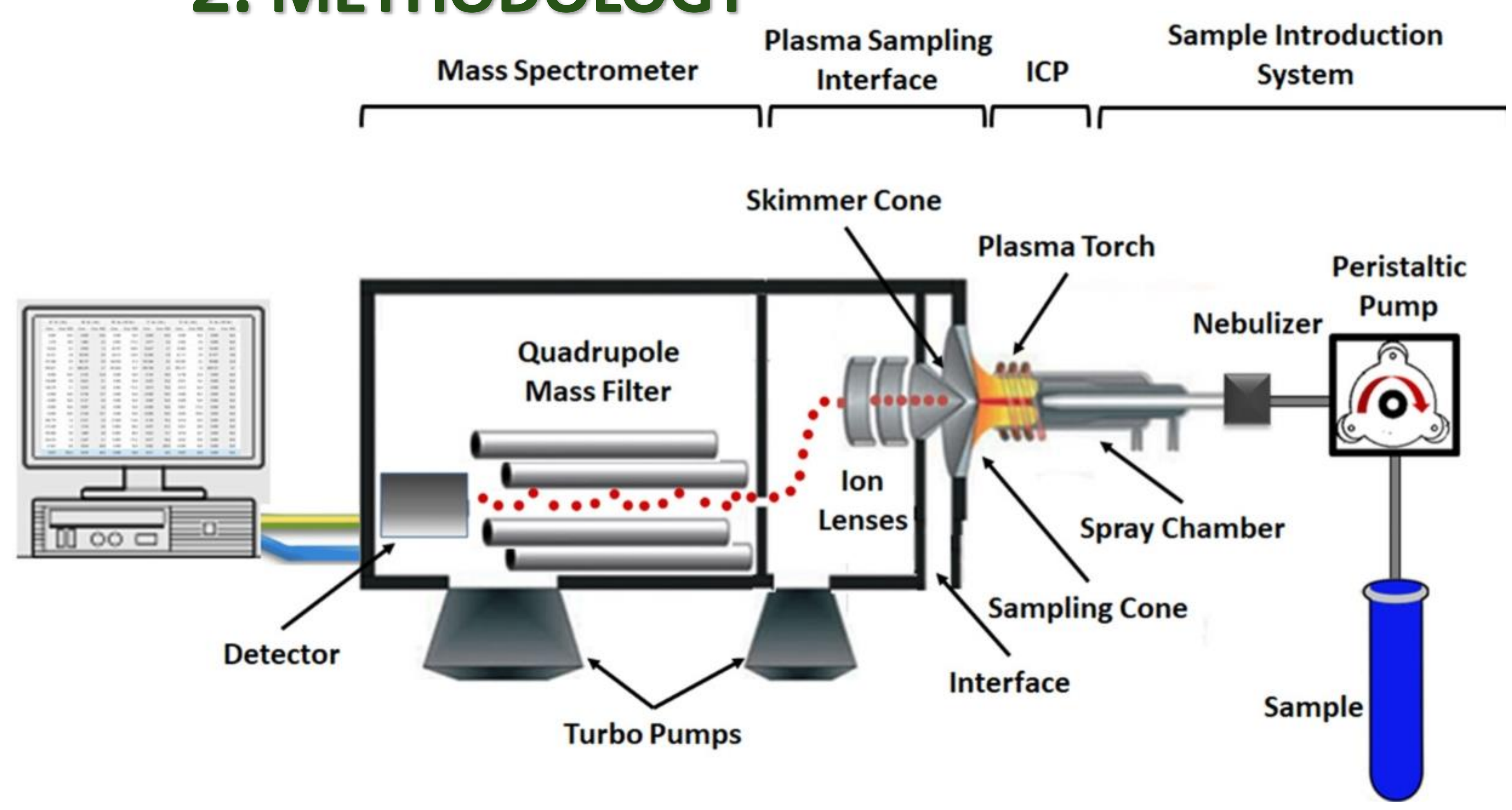
➢The pollution of the planet has exceeded all limits. One aspect of concern is the environmental burden caused by heavy metals. The issue with these metals is that they tend to accumulate in the environment, leading to adverse effects.

➢Over the past century, planetary pollution has surpassed all boundaries. Climate change has manifested through extreme weather conditions, resulting in thousands of casualties. However, pollution from industrial activities and modern lifestyles has various facets, one being the environmental burden of heavy metals .

➢ In this study, we used two types of activated carbon to remove or reduce the levels of the following metals detected within permissible limits in the wines we examined, (Lead, Cadmium, Mercury, Silver, Zinc, Chromium, Cobalt, Nickel, Selenium , Arsenic) as well as the chemical substance *N*-(phosphonomethyl)glycine. The first type of activated carbon came from potato peels, while the second from banana peels.

➢The results were very satisfactory using 1000 grams per ton of activated carbon regarding the reduction of the content of several metals as well as the chemical substance we are examining.

## 2. METHODOLOGY




### Wine analyses

| (µg) | Pb | Cd | Hg | Ag | Zn | Cr | Co | Ni | Se | As | Glyphosate |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Non AC Wine 1 | 17.6 | 0.42 | <0.1 | <0.1 | 363 | 10.5 | 5.4 | 19.1 | 0.62 | 3.7 | 4.8 |
| AC-Ban | 17.5 | 0.39 | <0.1 | <0.1 | 303 | 9.3 | 5.1 | 18.2 | 0.37 | 3.1 | 4.6 |
| AC-Pot | 17.5 | 0.38 | <0.1 | <0.1 | 301 | 9.3 | 5.1 | 18.3 | 0.37 | 3.1 | 4.6 |
| | | | | | | | | | | | |
| Non AC Wine 2 | 10.7 | 0.32 | <0.1 | <0.1 | 1854 | 35.3 | 5 | 34.1 | 2.1 | 1.2 | 6.3 |
| AC-Ban | 10.6 | 0.31 | <0.1 | <0.1 | 1695 | 32.1 | 4.8 | 33.6 | 1.8 | 0.8 | 6.1 |
| AC-Pot | 10.6 | 0.31 | <0.1 | <0.1 | 1693 | 32.1 | 4.8 | 33.5 | 1.8 | 0.8 | 6.1 |
| | | | | | | | | | | | |
| Non AC Wine 3 | 14.5 | 0.32 | <0.1 | <0.1 | 1078 | 13 | 4 | 26.3 | 0.59 | 3.4 | 12.1 |
| AC-Ban | 14.3 | 0.3 | <0.1 | <0.1 | 1007 | 12.1 | 3.9 | 25.2 | 0.51 | 2.6 | 11.7 |
| AC-Pot | 14.3 | 0.3 | <0.1 | <0.1 | 1008 | 12.1 | 3.9 | 25.1 | 0.51 | 2.6 | 11.7 |
| | | | | | | | | | | | |
| Non AC Wine 4 | 3.6 | 0.16 | <0.1 | <0.1 | 700 | 7.5 | 1.8 | 24.1 | 0.35 | 0.72 | 3.8 |
| AC-Ban | 3.4 | 0.11 | <0.1 | <0.1 | 589 | 6.4 | 1.8 | 23.4 | 0.27 | 0.62 | 3.6 |
| AC-Pot | 3.4 | 0.1 | <0.1 | <0.1 | 591 | 6.4 | 1.8 | 23.3 | 0.28 | 0.63 | 3.6 |
| | | | | | | | | | | | |
| Non AC Wine 5 | 7.3 | 0.17 | <0.1 | <0.1 | 988 | 6.7 | 4.3 | 22.8 | 1.2 | 2.1 | 4.3 |
| AC-Ban | 7.1 | 0.15 | <0.1 | <0.1 | 975 | 5.8 | 4 | 21.5 | 1 | 1.8 | 4 |
| AC-Pot | 7.1 | 0.15 | <0.1 | <0.1 | 980 | 5.8 | 4.1 | 21.3 | 1 | 1.7 | 4.1 |
| | | | | | | | | | | | |
| Non AC Wine 6 | 18 | 0.28 | <0.1 | <0.1 | 1285 | 14 | 4.9 | 29 | 1.4 | 1.8 | 7.3 |
| AC-Ban | 17.4 | 0.26 | <0.1 | <0.1 | 1057 | 12.8 | 4.7 | 28.5 | 1.1 | 1.5 | 7 |
| AC-Pot | 17.5 | 0.26 | <0.1 | <0.1 | 1069 | 12.8 | 4.7 | 28.5 | 1.1 | 1.5 | 7 |
| | | | | | | | | | | | |
| Non AC Wine 7 | 7 | 0.2 | <0.1 | <0.1 | 533 | 5.3 | 1.9 | 13.3 | 0.21 | 1.2 | 11 |
| AC-Ban | 6.8 | 0.18 | <0.1 | <0.1 | 400 | 4.6 | 1.8 | 12.8 | 0.16 | 1 | 10.8 |
| AC-Pot | 6.8 | 0.18 | <0.1 | <0.1 | 401 | 4.6 | 1.8 | 12.8 | 0.16 | 1 | 10.8 |
| | | | | | | | | | | | |
| Non AC Wine 8 | 18 | 0.19 | <0.1 | <0.1 | 354 | 2.7 | 2.3 | 13.5 | 0.31 | 4.3 | 7.1 |
| AC-Ban | 17.3 | 0.12 | <0.1 | <0.1 | 274 | 2.4 | 2.2 | 13.2 | 0.2 | 4.1 | 7 |
| AC-Pot | 17.4 | 0.12 | <0.1 | <0.1 | 271 | 2.4 | 2.2 | 13.1 | 0.21 | 4 | 7 |
| | | | | | | | | | | | |
| Non AC Wine 9 | 1.7 | 0.16 | <0.1 | <0.1 | 470 | 2.9 | 1.5 | 10 | 0.31 | 0.59 | 3.4 |
| AC-Ban | 1.5 | 0.15 | <0.1 | <0.1 | 435 | 2.4 | 1.3 | 9.8 | 0.22 | 0.48 | 3.3 |
| AC-Pot | 1.5 | 0.15 | <0.1 | <0.1 | 432 | 2.4 | 1.3 | 9.8 | 0.23 | 0.49 | 3.3 |
| | | | | | | | | | | | |
| Non AC Wine 10 | 23 | 0.17 | <0.1 | <0.1 | 351 | 5.1 | 2.3 | 26.3 | 0.81 | 0.71 | 6.2 |
| AC-Ban | 22.7 | 0.16 | <0.1 | <0.1 | 302 | 4.3 | 2.1 | 25.7 | 0.53 | 0.57 | 6 |
| AC-Pot | 22.8 | 0.16 | <0.1 | <0.1 | 304 | 4.3 | 2.1 | 25.8 | 0.51 | 0.58 | 6 |

## 3. RESULTS

### Morphological characterization

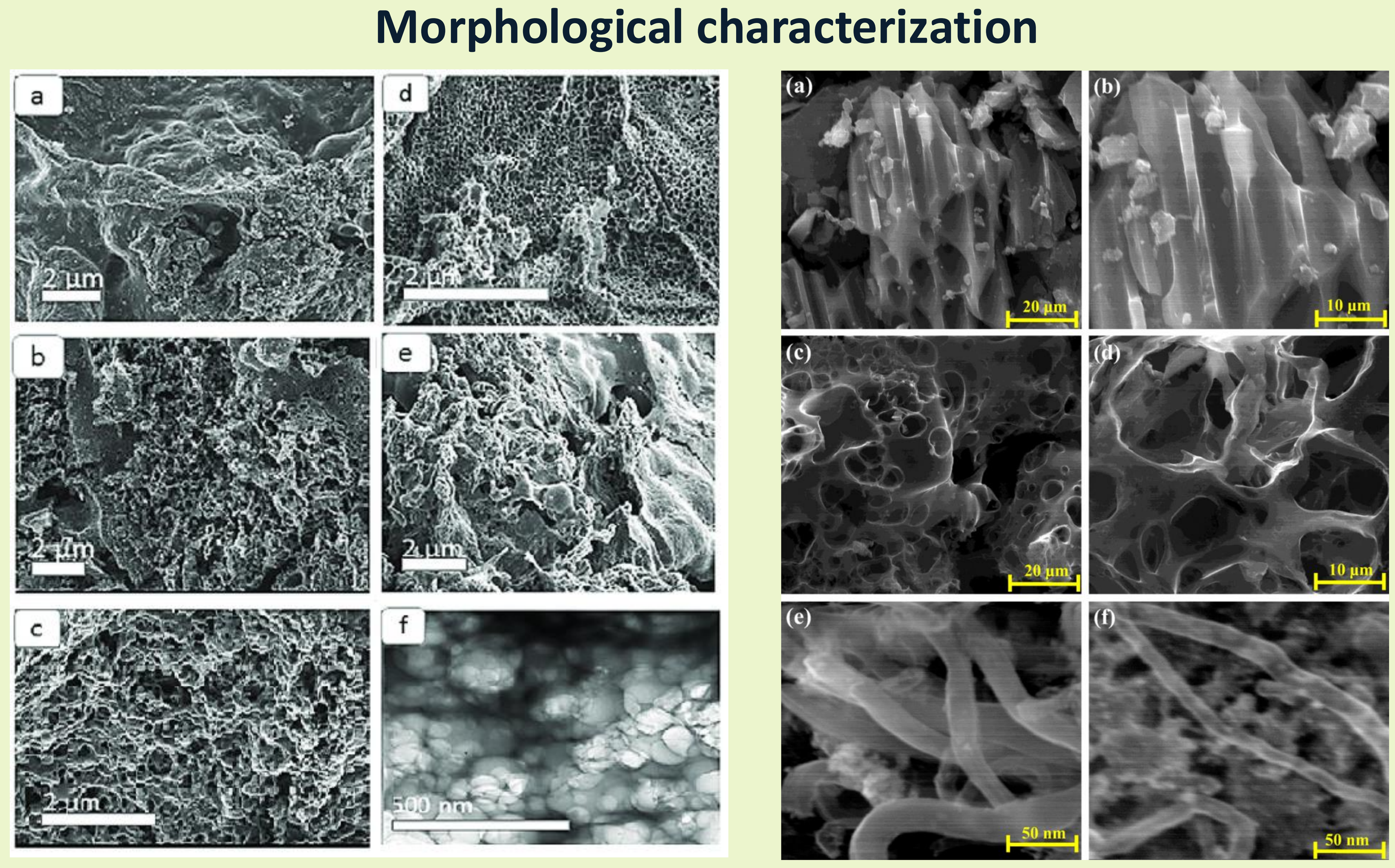


*Figure 1. SEM of activated carbon derived from banana peels (left) and potato peels (right)*

## 4. CONCLUSIONS

- The different origins of the activated carbons used to reduce the content of heavy metals and the chemical substance did not have significant differences. The reduction was almost similar in the case of both the carbon derived from potato and the carbon derived from banana.
- The higher the concentration of the substance we detected, the greater the quantitative reduction we achieved with the application of activated carbon.
- In metals where quantitative detection was very low, such as mercury and silver, there was no reduction or, if there was, it was undetectable.
- The relationship between the atomic radius of each element and the reduction rate is still under investigation. To draw a safe conclusion, we must also take into account the saturation of the active centers of carbon.

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