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Quercetin extracted from onion skin is an efficient green inhibitor against the corrosion of metals.

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Abstract

Flavonoids are polyphenol substances that are common in many plants and possess a wide spectrum of biological activities. Among them, an important polyphenol compound is quercetin. This compound is contained in red onion 19.93mg/100g and in yellow onion 13.27mg/100g. Quercetin has anti-inflammatory, anti-histamine, anti-cancer effects and other biological activities. In recent years quercetin is proved to be an efficient inhibitor against the corrosion of metals and alloys. Both inorganic and organic synthetized compounds, have a toxic effect upon environment and human lives. A great interest are represented corrosion's inhibitors, which are extracted from different plants, known as green inhibitors. These compounds are cheap and safety handled to be used as corrosion inhibitors.

The extract of quercetin from onion skin, represents a great inhibitive action against corrosion of metals and alloys in acidic media. Quercetindiglucoside and monoglucoside account for up to 93% of total flavonol content in onion.

Quercetin from the onion skin was obtained by alcoholic and water extraction. The extract was stored at 4^{o}C and in the dark.

The product of extraction was analyzed with infrared (IR) and ultraviolet (UV) spectroscopy, in order to define its chemical structure. Also we defined the yield, density and molecular weight of the product. The product of extraction was quercetin and we propose to use it as corrosion inhibitor.

Keywords: extraction, onion skin, quercetin, corrosion inhibitor.

1. Introduction

Corrosion is the deterioration of materials by chemical attack or reaction with their environment. It is a constant and continuous problem, often difficult to eliminate completely. Prevention of corrosion would be more practical and achievable than complete elimination [1]. The use of inhibitors for the control of corrosion of metals and alloys, is one of the best options among the acceptable practices to reduce, or prevent corrosion.

Several inhibitors in use are either synthesized from cheap raw material or chosen from compounds having heteroatoms in their aromatic or long chain carbon systems. However most of these inhibitors are toxic to the environment.

In an attempt to find corrosion inhibitors which are environmentally safe and readily available, there has been a growing trend in the use of natural products such as leaves or plant extracts as corrosion inhibitors for metals in acid cleaning process. A lot of work has been done using economic plants such as Allium Cepa (onion skins), for preparation of the green inhibitor, quercetin for the protection of metals and alloys in acidic media [2].

Onions have received considerable attention for their healthful and functional benefits. Phytochemicals include the organosulfur compounds such as cepaenes and thiosulfinates, the large class of flavonoids including quercetin and pigments such as anthocyanins, are found in red onions. Red onion skin has been analyzed and found to contain quercetin, a

compound with conjugated system that contain heteroatoms and carbonyl groups that are electron rich, that may likely inhibit the corrosion of metals because serve as a good adsorption site into the metal surface. So, the inhibitory action of red onion skin, was due to presence of quercetin [1], [3].

The molecular structure of quercetin is given in (Fig. 1).

2. Material and Methods

After being collected, the onion skins were washed, shade dried and stored at room temperature in darkness. Before extraction, they were powdered by an electrical mill [4].

2.1. Water extraction

One gram (1 g) of onions skin powder was taken and it was mixed with 100 ml of bi-distilled water. The mixture was boiled in water bath at 100^{o}C for one hour. The onions skin with water were leave to cold and after filtration, the extract was stored in dark bottle and in low temperature.

2.2Extraction using Soxhlet extractor

Prior to the solvent extraction, 100 ml of 95 % ethanol was prepared and kept still of the extractor. 5 grams of onions skin powder was placed in thimble with the help of a filter paper and then the condenser was connected to it. Using the Soxhlet apparatus and heating of the mixture, continuous extraction was performed for three (3) hours [5].

3. Results and Discussion

For the product of extraction were defined the yield, density, pH and melting point. Also by means of osmometer KNAUER MEMBRANE – OSMOMETER, the molecular weight was estimated for the product.

The extract was further analysedwith a spectrophotometer JENWAY 6800 UV/Vis and infra red (IR) spectroscopywith a spectrophotometer Nicolet 6700 OMNIC, in order to define the chemical structure of quercetin.

The analyses of UV gave a broad band in the absorption spectrum of quercetin with maximum at 375 nm, therefore quercetin can be determined by its intrinsic absorption. This band is similar with the band in the studies [6].

The obtained results are given in the Table 1.

We got similar data with those reported in the literature, therefore we re-confirmed that the onions skin are a good source of quercetin [6].

Table 1. Data of analyses of extract of onion skins

Extract sample	*Yield (%)*	*Density (g/ml)*	*pH*	*Melting point (^{o}C)*	*Molecular weight (g/mol)*
1	19.9	1.78	7.1	318	316
2	19.7	1.79	7.21	321	325
3	19.1	1.82	7.15	319	329

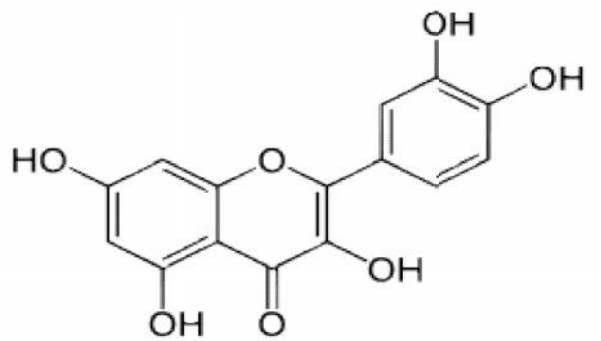

Figure 1. Molecular structure of quercetin

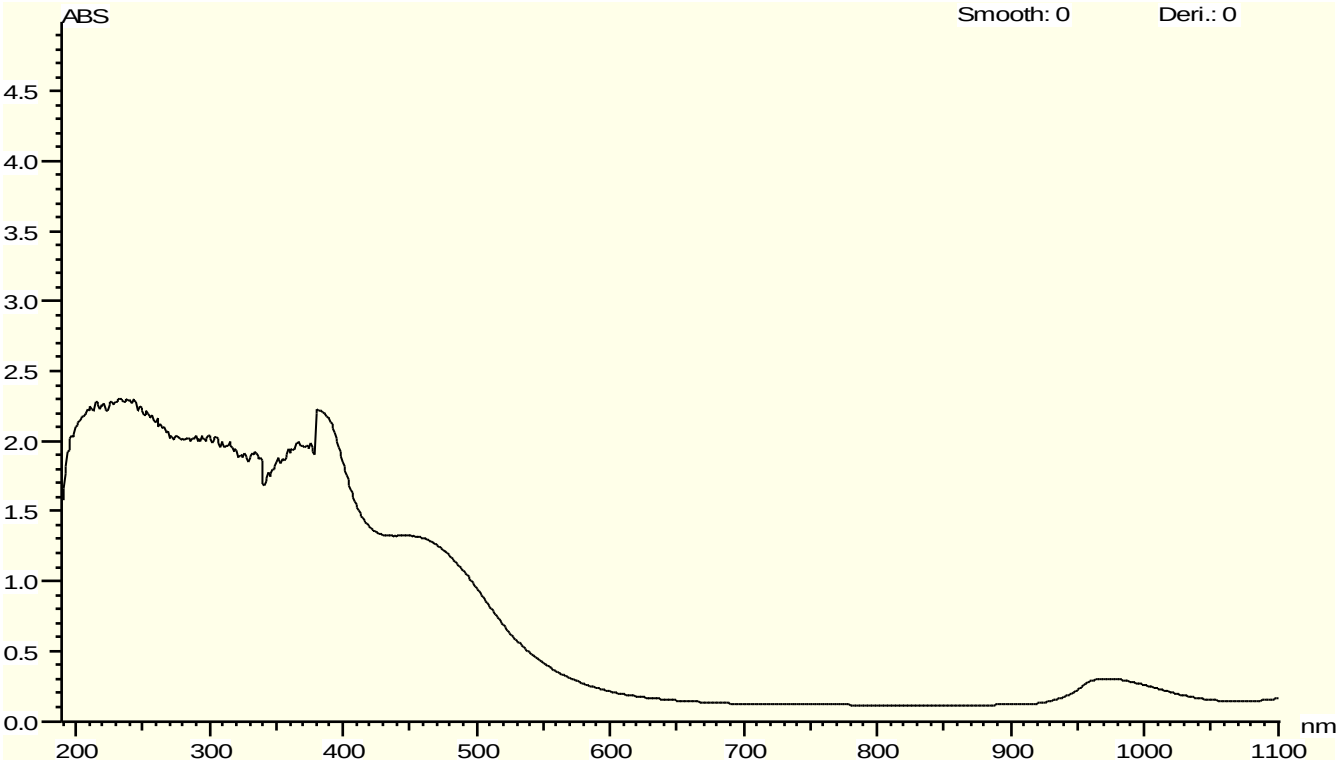

Figure 2. UV spectra of extract from onion skins

4. Conclusions

1. Quercetin can be easily obtained from the onions skins, by extraction method. Performed extraction with mixture with water in water bath in 100^{o}C and with ethanol 95% with Soxhlete, was stored at low temperature and in the dark.
2. Quercetin extraction yield of quercetin from onions skins was studied and the degree of purity of the products of the extraction, was good in this temperature without degraded the product.
3. The measurements of density, pH, melting point and molecular weight for the product of extraction show values which are much closed with them of the literature.
4. Analysis of the final product of extraction, and especially by means of UV and IR spectroscopy, show that is performed a good extraction of quercetin contained at onion skins. By comparison of these spectra with those of the literature, is concluded that the structure of the extract is very similar with that of quercetin.
5. It is concluded that the quercetin extracted from onion skins, may be used as a good inhibitor against the corrosion.

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6. References

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