# Ibuprofen tablets with flavor added survive better in space

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Ibuprofen tablets modified to survive in space have returned to Earth and shown that those with added flavor survived better with less degradation than those with no added taste.

Researchers from the International Flavor Research Center at the University of Nottingham worked with the University of Adelaide on the research that also showed that an iron oxide coating formed during tablet manufacture could protect Ibuprofen.

"Medicines taken on space missions are exposed to cosmic rays which limit their 'space shelf life' and can even lead to the formation of toxic substances as the drug content declines," said the University of Adelaide's Professor Volker Hessel, Research Director of the Andy Thomas Center for Space Resources and Professor in the School of Chemical Engineering and Advanced Materials who led the project to send tablets into space.

"We have tested and proven countermeasures to the degrading effects of cosmic rays by sending ibuprofen tablets made in our laboratory to the International Space Station (ISS) for six months and checking them on their return.

"Four of the six ibuprofen tablets from outside the ISS, each made with a distinct formulation and protection concept, significantly decomposed to a high number of ibuprofen fragments. The tablet with highest iron oxide content in the coating showed only minor ibuprofen loss."

A coating of iron oxide was formed under the pressure of compacting the tablets during manufacturing in the lab.

The team developed special tablet formulations of the anti-inflammatory drug that include solid, dense drug packing which alone protects the drug from damage by some of the cosmic radiation. They also modified the chemical nature of ibuprofen by complex formation of the drug with the excipients, resulting in a "stronger" ibuprofen. Excipients are substances that are included in a tablet in addition to the drug component that has a variety of uses like assisting the manufacturing process or enhancing the

stability of the drug.

"Many flavor compounds have multiple properties in foods and pharmaceutical, offering structural and chemical benefits as well as imparting pleasant aromas or flavors, these findings could have benefits on Earth as well as in space," said Professor Ian Fisk, head of the International Flavor Research Center at the University of Nottingham.

The tablets were sent to the ISS for six months in a partnership between the University and space technology companies Space Tango and Aegis Technologies. One batch (60 tablets) was carried inside the space station and one batch was outside the station (6 tablets) in the Materials International Space Station Experiment (MISSE) platform. They were exposed to one of the harshest environments known.

When they returned from their epic journey the space tablets were compared to a control batch of tablets left on Earth.

"But to our surprise, natural flavors, which were added to the tablets by our research partners led by Professor Ian Fisk (International Flavor Research Center, University of Nottingham) seemed to be help stabilize the ibuprofen even when no large iron oxide content was present.

"University of Adelaide researchers are continuing their investigations in the lab by using different radiation sources to test their effects on pure ibuprofen on its own as well as inside tablets.

"The results from sending tablets to the ISS shows that experiments carried out in space can provide insight for improving manufacturing on Earth," said Professor Hessel. "High energized photon radiation—synonymous with the cosmos' gamma radiation—is likely to be the biggest threat to medicines in space as it's been found to penetrate the tablets and destroy the ibuprofen."

Provided by University of Nottingham

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