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Sustainable Packaging in Microgravity for Injectables

Anupam Chanda

Packaging and Polymer Science, Bioxytran Inc, Boston, USA.

*Corresponding Author:** Anupam Chanda, Packaging and Polymer Science, Bioxytran Inc, Boston, USA.

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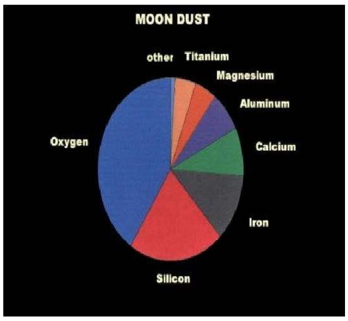
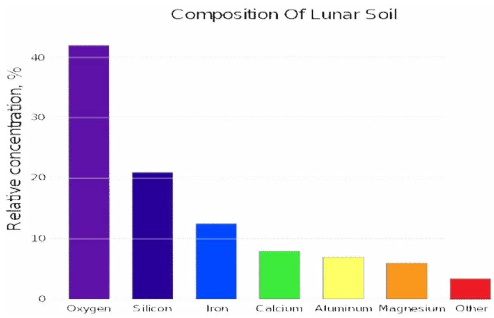
Abstract

We all know world is really looking for sustainable packaging in order to protect the environment. Microgravity environment is quite new for human beings so right from the beginning our aim has to be every innovation should be sustainable in that critical environment. From MOON to MARS and other planets we need to develop all kinds of injectable devices according to the respective planets environment and those are too critical. Few areas are playing vital roles like high Radiations, extreme Temperatures, variations of Gravity in different locations in one particular planet.

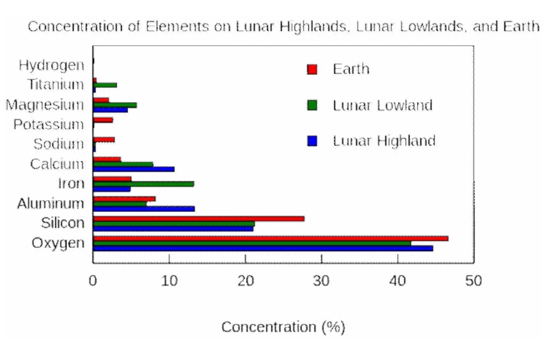
MOON

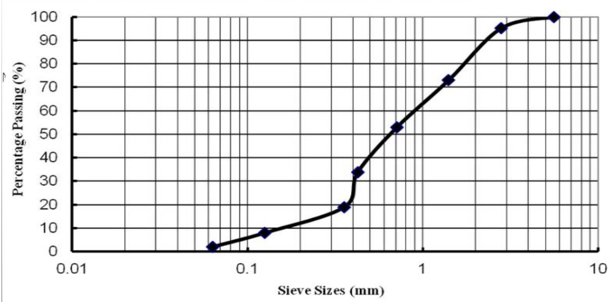
Sand on the MOON





Particle size Analysis of LUNAR SANS





Lunar Glass

There are several reasons why glass made from lunar sand is better quality compare to Earth and those are more suitable to use for " Injectable products" for Pharma and sustainable in the Microgravity environment.

Advantages in MOON Sand

No atmosphere: Since there is no O2 and other interactive gasses so there is no chance to melt the glass. This prevents oxidation; Chemical reactions that can lead to impurities in the glass. There is no chance to form Air bubbles during manufacturing of glass and inside the product as well.

Low gravity: This hugely influence for formation of glass. Exceptionally high Vacuum: It helps a lot during the formation of glass.

Purity: Achieve optical properties surpassing conventional production constraints, opening up new markets and product categories.

Autoinjector: This will manufacture from Aluminum not from Polymers in Lunar surface since petroleum not yet invented in MOON and MARS. Syringes will be made in glass. Going to manufacture all medical devices in MOON and MARS surface. This is the most logical predictions.

Image

Gold Coated Vial for Lunar Surface

Radiation Effect on Lunar Surface and Probable Solutions to Protect Injectable Products

Absorber tube of a parabolic trough collector (PTC The results). showed that the black chrome coating with 98% purity had the highest absorption in the ultraviolet and visible range and the matt black paint had the lowest thermal conductivity.

This has been measured an average total radiation absorbed dose rate in silicon of 13.2 ± 1 µGy/hour and a neutral particle dose rate of 3.1 ± 0.5 µGy/hour. Many pharmaceutical products are heat labile are being sterilized by gamma irradiation or at least being investigated for compatibility with this mode of sterilization. Furthermore, many powders used in the pharmaceutical industry either as active pharmaceutical ingredients or pharmaceutical adjuncts, are heavily contaminated with microorganisms because of their natural source, thus presenting a health hazard to the consumer. Frequently they do not withstand heating processes to reduce the initial microbial load, and so, a low radiation dose (less than 10 kGy) may be sufficient to reduce the bioburden by several orders of magnitude.

Radiation Effect Observed in Following Few Products

Zolidronic Acid

The effects of gamma irradiation at ambient temperature at a dose of 25 kGy on the stability of potassium clavulanate, amoxicillin sodium and their combination as powders were investigated . A decrease in purity and increase in degradation products up to 30 days after the irradiation were evaluated by reversed phase HPLC. A comparison between unirradiated and irradiated amoxicillin sodium, performed within 24 h following the irradiation process, showed no significant changes.

Paclitacil Injection

The effect of ionizing radiation on clarithromycin powder was investigated. HPLC analysis confirms its stability at 2 and 5 kGy radiation doses with no observed degradation products. However, at 25 kGy, the antimicrobial activity was reduced by 1.27%, and an unacceptable increase of a single impurity was observed.

Azithromycin

The influence of gamma irradiation (up to 25 kGy) on the physicochemical properties of the NSAIDs, naproxen sodium and diclofenac sodium, when incorporated in PLGA microspheres. Drug loading of irradiated and non-irradiated microspheres was essentially the same. A significant difference was noticed, however, between particle sizes of the irradiated and non- irradiated formulations. In release studies, the amount of active substance released from PLGA microspheres

Enzymes and proteins

The effect of gamma irradiation (25 kGy) on peptide-containing hydrophilic PLGA microspheres, showed that on the basis of HPLC analysis, the peptide content of the microspheres was lowered. In-vivo evaluation, however, of the non-irradiated and the 15 kGy irradiated microspheres showed no marked differences.

Carbohydrates

The effects of irradiation on various carbohydrates both in the solid phase and in aqueous solution. A method for radiation sterilization of certain sugars, particularly aqueous dextrose solution, by gamma irradiating over an extended time period of not less

Anticancer Drugs

Eelectron beam irradiation of the anticancers, flutamide, ifosfamide and aminoglutethimide in microcrystalline form, two species identified in flutamide were assigned to a more stable tertiary carbon-centred radical, and a less stable aryl radical or nitrogen-centred radical cation. Two components were found in if osfamide with one being the radical formed on the loss of a chlorine atom.

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