

# Design of 3D Printed Veterinary Capsule Devices for Supplement Administration †

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**Abstract:** Urea is commonly employed in ruminant feed supplementation, however, is rapidly hydrolyzed in the rumen. Therefore, modifying the urea release has become a pharmacotechnical challenge. In this work, a proof of concept study was developed to test the feasibility of using Fused Deposition Modeling-3D printing (3DP) to create veterinary capsule devices (CDs) that could allow the control of urea release. Three designs were assayed: D1 = one-compartment capsule with body and cover printed in polylactic acid (PLA), D2 = one-compartment capsule with the body of PLA and cover of polyvinyl alcohol (PVA), and D3 = multi-compartment capsule with cover and body of PLA, the body presenting a PVA orifice in one extreme and five PVA partitions inside. The release of urea from the CDs was performed in 1 liter of distilled water, 40 °C, and 50 rpm. Two sinkers of different weights and two types of paddles were evaluated. D1 showed no release of urea within 24 hours. D2 exhibited a retard release without the influence of sinkers and paddles. D3 showed immediate and prolonged profiles, thus, the release was affected by sinkers/paddles and some printing errors. These preliminary designs showed the possibility of using 3DP as a technological platform to modify the urea release in ruminant feed supplementation.

**Keywords:** urea; 3D printing; proof of concept; veterinary supplements; capsule devices; modified-release.

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## **Conflicts of Interest**

The authors declare no conflict of interest.