cbecimat26
26° Congresso Brasileiro de Engenharia e Ciência dos Materiais
22 a 26 de novembro de 2026
Costão do Santinho
Florianópolis-SC

A FEASIBILITY STUDY OF AN EXTRUSION-BASED ADDITIVE MANUFACTURING OF VETERINARY ENDOPROSTHESIS

Táboas, A.G.[1], (andregtaboas@usp.br); **Vieira, G.N.**[1], (gabriel_natulini@usp.br);
Silveira, Z.C[2], (silveira@sc.usp.br); **Vieira R.A.M.**[3], (rafa_melovieira@usp.br)
Ambrósio, C.E[3], (ceambrosio@usp.br); **Branciforti, M.C.**[1], (marciacb@sc.usp.br)
[1] Department of Materials Engineering, University of São Paulo
[2] Department of Mechanical Engineering, University of São Paulo
[3] Department of Veterinary Medicine, University of São Paulo

Introduction

- **Research gap:** few studies in the literature report veterinary endoprostheses development based on additive manufacturing for treatment of urinary infections;
- **Case study:** Ureteral catheters used veterinary treatments for small felines are required to be flexible enough to be modeled in a double-J geometry;
- **Motivation:** reduce the animal suffering during the post-chirurgical process) and localize the production by 3D printing

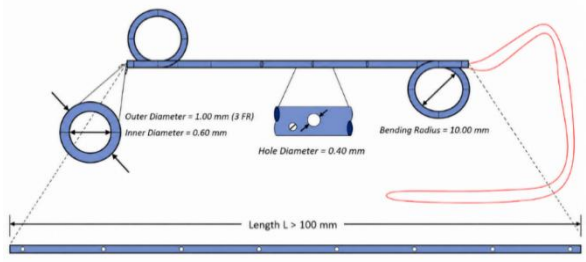


Figure 1. Commercial catheter scheme.

Objectives

- Biomaterials and manufacturing process systematic review for veterinary ureteral catheters;
- Additive calibration process of PCL for ureteral catheter, with open longitudinal geometry.

Methodology



- **Feedstock** (Filament): PCL 100 Facilan ™ (Supplier: 3D4Makers)
- **Equipment**: 3D Printer (CR 10-SE 0 Creality) and **Drying and Sterilization Oven**, Model SP-100-A

Figure 2. Creality CR-10 SE.

Table 1 - Temperature extrusion test for the PCL

Test	Support	T_{table} (°C)	Process speed (mm/s)	Head acceleration (mm/s²)	Evaluation
1	Support ($\theta \leq 60°$)	Process interruption	60	5000	Support deformation
2	No support	60	60 mm/s	5000 mm/s²	Drag of material
3	No support	40	60 mm/s	5000 mm/s²	Drag of material
4	No support	40	40 mm/s	5000 mm/s²	Less drag of material
5	No support	25	40 mm/s	500 mm/s²	Few deformations at the edges
6	No support	25	20 mm/s	200 mm/s²	Stable printing

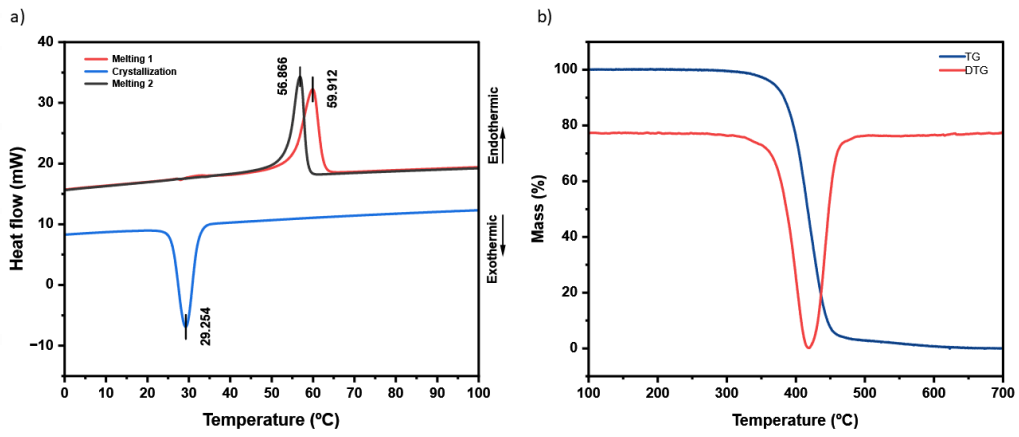


Figure 3. DSC and TGA curves of PCL filament.

- The PCL 3D printed catheter was submitted to termal analysis to verify its safety inside small felines body. The mechanical properties were compared with TPU comercial catheters.

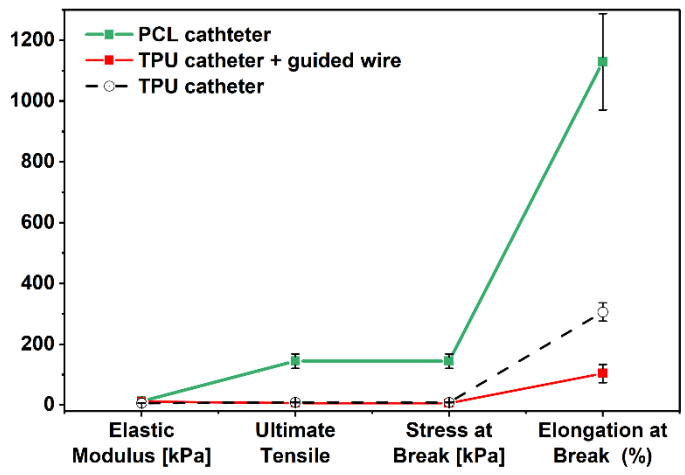


Figure 4. Mechanical Properties of PCL catheter and TPU catheter.

Results and Discussion

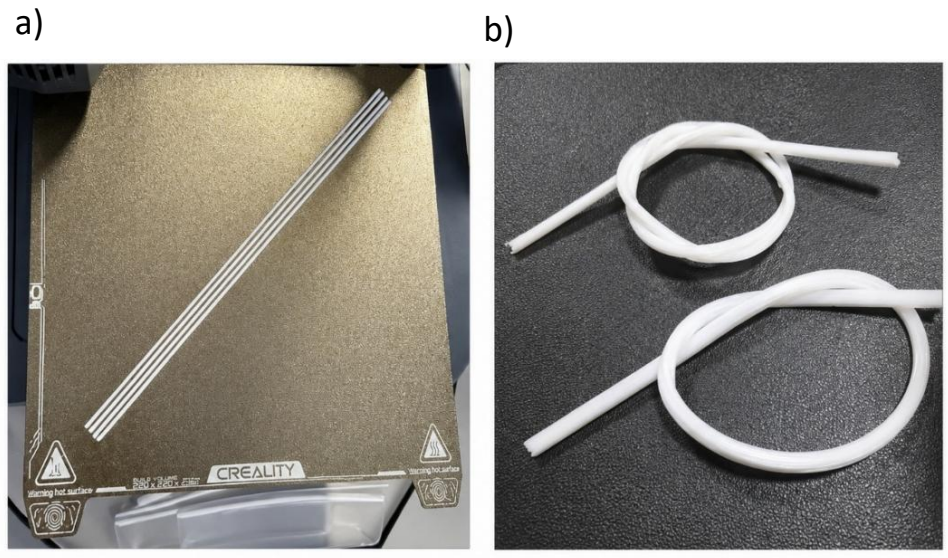


Figure 5. PCL catheter printing. (a) Series printing. (b) Successfull print.

Conclusions

- Successful 3D printing and conformation of PCL ureteral catheters.
- Thermal safety, and mechanical stability for feline applications.
- Open-model design completed as a first step
- Further optimization and biological testing could enable its development as a national product for feline kidney treatment.

References and acknowledgments

1. Jin L, Yao L, Yuan F, Dai G, Xue B. Evaluation of a novel biodegradable ureteral stent produced from polyurethane and magnesium alloys. J Biomed Mater Res B Appl Biomater. 1º de maio de 2021;109(5):665–72. doi:10.1002/JBM.B.34730 PubMed PMID: 32929829.
2. Liatsikos EN, Kallidonis P, Stolzenburg JU, Karnabatidis D. Ureteral stents: past, present and future. Expert Rev Med Devices. 2009;6(3):313–24. doi:10.1586/ERD.09.5 PubMed PMID: 19419288.
3. Jang JW, Min KE, Kim C, Wern C, Yi S. Rheological Properties and 3D Printing Behavior of PCL and DMSO2 Composites for Bio-Scaffold. Materials (Basel). 1º de maio de 2024;17(10). doi:10.3390/ma17102459 PubMed PMID: 38793525.