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Authors: Guo Shangxin, Shao Jingyuan, Gong Xingchu



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Paper-based analytical devices prepared with polycaprolactone printing and their application in the activity determination of mulberry extracts

Guo Shangxin, Shao Jingyuan, Gong Xingchu*

Pharmaceutical Informatics Institute, College of Pharmaceutical Sciences, Zhejiang University, Hangzhou 310058, China

*Corresponding Author E-mail: gongxingchu@zju.edu.cn, Tel.: 86-571-88208426, Fax: 86-571-88208426

Highlights:

- A new method for preparing paper-based analytical devices (PADs) with the assistance of 3D printing technology was presented and polycaprolactone was selected as the 3D printing material to form hydrophobic barriers.
- The activity of mulberry extracts in the inhibition of α -glucosidase was determined on the PADs with a smartphone as the detector.

ABSTRACT

A new method for preparing paper-based analytical devices (PADs) with the assistance of 3D printing technology was presented. Polycaprolactone was used as the 3D printing material to form hydrophobic barriers. First, polycaprolactone was 3D printed on filter paper. The polycaprolactone-modified paper was then prepared by heating. Experiments on α -glucosidase inhibition activity were carried out in the hydrophilic circles on the modified paper. Color data were read with a smartphone. After comparison of the multiple color indices, component Y was selected because of its low detection limit. The analytical parameters were optimized with the data collected from the definitive screening designed experiments. Finally, the activity of mulberry extracts in the inhibition of α -glucosidase was determined, and the results obtained using the PADs were compared with the results obtained using microplates. No significant differences were observed between the results obtained using these two methods. The activity of α -glucosidase can be retained with the addition of bovine serum albumin as a stabilizer without significantly influencing the color of the reaction results. Bioassays of traditional Chinese medicines using PADs are accurate, convenient, and less expensive.

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