

## Monitoring of vinyl phosphonic acid chemical and radiation grafting on natural fiber compound

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In recent years, awareness of the impact of human activity on the environment and natural resources has encourage researchers to develop sustainable technologies by using biobased materials. Among these biomaterials, lignocellulosic resources and more precisely the inedible miscanthus x giganteus grass (MxG) [1] mainly composed of three biopolymers (i.e., cellulose, hemicellulose, and lignin) has attracted considerable attention. This crop is a sterile and non-invasive that requires little or no herbicide and nitrogen. It grows over 3 m tall per year and produces 15–25 tons of dry matter per hectare. The flame retardant properties of this fiber could be improved by grafting flame retardants (RFs), most often phosphorus. Various techniques like irradiation and chemical reactions could achieve this goal [2]. In the present work, the incorporation of vinylphosphonic acid (VPA) flame retardants either by irradiation or chemical grafting (Figure 1) onto miscanthus fibers improves their flame retardant properties. Selective conventional extraction of the fiber components is carried using the total acid hydrolysis of the carbohydrate portion and acid-chlorite delignification for acid-insoluble lignin and holocellulose (cellulose and hemicellulose fraction) recovery respectively, to identify and quantify the part of the fiber where phosphorus is fixed. The results show a distribution of phosphorus mainly on holocellulose in the case of irradiation and on lignin by chemical reaction. Thus, phosphorus is grafted onto lignin and holocellulose in different proportions depending on the treatment conditions applied to the fibers.

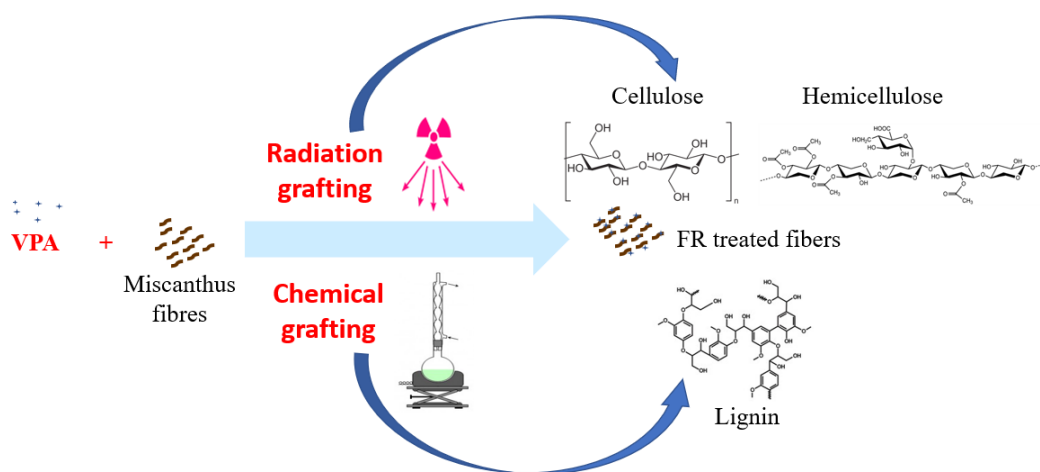


Figure 1. Irradiation and chemical grafting of VPA on miscanthus fibers

### References

- [1] R. El Hage et al., *J. Bioresour. Technol.*, **2010**, 101, 9321.  
 [2] R. Hajj et al., *J. Polym. Degrad. Stab.*, **2018**, 147, 25.