

**ABSTRACT** The present study deals with the production and extraction of  $\beta$ -carotene from *Penicillium commune* using surface culture fermentation technique. For the most cost-effective growth of  $\beta$ -carotene, an optimal aqueous media with 5g of carrot fruit peels were tested, and chosen for further optimization. The media was then adjusted for maximum growth. Different salts, temperatures and nitrogenous sources were administered at various pH levels. The greatest growth of *Penicillium commune* as well as  $\beta$ -carotene was seen in 5g of carrot fruit peels when combined with 1.5g  $MgSO_4$ , 0.5g  $FeSO_4$ , 1.0g  $ZnSO_4$ , 0.2g  $NaCl$  salt, 5.4 pH and 25°C temperature. The amount of  $\beta$ -carotene was calculated by correlating the standard curve from the carotene solutions obtained using the spectrophotometry technique with solutions taken from the strain's cell mass. The maximum  $\beta$ -carotene ( $2.45 \pm 0.14 \mu g/g$ ) was produced at pH 5.4. It was established that the media made with carrot waste had the highest levels of  $\beta$ -carotene and may be supplied for enhancement using a variety of tools. To compare the  $\beta$ -carotene content of carrot juice with mycelial extract of *Penicillium commune*, TLC analysis was performed by using seven different mobile phases. The best comparison was noted with mobile phase C (Ethyl acetate: Methanol: Water (80:15:5)), and  $R_f$  values of standard, supernatant and mycelial extract were 0.843, 0.343 and 0.250 respectively for mobile phase C. The research revealed that carrot peel and juice waste could be a valuable addition for the manufacture of  $\beta$ -carotene for the nutraceutical, culinary, and cosmetic industries.