*312-часовой ферментации, что в 5,8 раз больше по сравнению с обычной сывороточной средой.*

This project was conducted to determine the optimum fermentation condition for the production of citric acid by Aspergillus niger NRRL 567 grown using cheese whey. A first set of experiments (Optimization 1) was studied to optimize initial level of stimulators (methanol, olive oil and phytate) for citric acid production using the central composite design (CCD). The citric acid production was identified to correlate to the initial concentration of stimulators. The application of the statistical optimization method using CCD resulted in an improvement of maximum citric acid production from 12.8 to 41.8 g/l in validation experiment. Followed a second experiment (Optimization 2) evaluated initial fermentation parameters (initial pH, fermentation time and inoculum density) on citric acid production using a CCD. The experiment indicated that initial pH and inoculum density had a significant effect on citric acid production, while fermentation time was insignificant in the tested ranges. Testing these optimal fermentation conditions using two-step optimization, a maximum citric acid concentration of 74.6 g/l was obtained after 312 h of fermentation representing a 5.8-fold increase compared to basal whey medium.

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## УТИЛИЗАЦИЯ ПРОМЫШЛЕННЫХ ОТХОДОВ С ПОМОЩЬЮ ФЕРМЕНТАТИВНОЙ ПЕРЕРАБОТКИ (THE PLANT WASTE UTILIZATION VIA USING ENZYMATIC TRANSFORMATION)

*Изучены антиопухолевые эффекты ginsenoside compound K (C-K) и продукты ферментативного превращения (ETP$_s$) из суммарных сапонинов в отходах листьев Panax notoginseng (SLPN) с помощью β-глюканазы. Для обработки SLPN использовался промышленный фермент β-глюканаза. Оп-*

*тимальные условия эксперимента обработки SLPN с помощью β-глюканазы таковы: концентрация субстрата 20 мг/мл, объемная доля фракции энзима 10%, температура 55С, pH 5,8, продолжительность 72 ч. $ETP_s$ были экстрагированы с применением макропористой смолы, выделены и очищены с помощью колоночной хроматографии на силикагеле и ТСХ. Два из основных соединений были идентифицированы как ginsenoside C-K [20(S)-protopanaxadiol-20-β-D-glucopyranoside C-K] и ginsenoside $M_c$ [20(S)-protopanaxadiol-20-O-α-L-arabinofuranosyl(1-6)-β-D-glucopyranoside], структура C-K и $M_c$ была доказана масс-спектроскопией. Результаты ингибирования роста на крысах, зараженных саркомными клетками $S_{180}$, с помощью $ETP_s$ и C-K показали, что замедление скорости роста опухоли под действием $ETP_s$ и C-K было 41,8 и 44,7% соответственно. Антиопухолевые эффекты были совершенно очевидны.*

Study the anti-tumor effects of ginsenoside compound K (C-K) and the enzymatic transformation products (ETPs) from the total saponins in leaves waste of *Panax notoginseng*(SLPN) by ß-Glucanase. An industrial enzyme ß-glucanase was used to transform SLPN. The optimal experiment conditions of SLPN transformed by ß-glucanase were obtained as following: 20mg/mL substratum concentrations, 10% enzymatic volume fraction, temperature 55°C, pH5.8, time 72h. ETPs were extracted by $D_{101}$ macroreticular resin, separated and purified by column chromatographies on silica gel and thin layer gel. Two of the main compounds was identified as: ginsenoside C-K [*20(S)-protopanaxadiol-20-O-* $\beta$ *-D-glucopyranoside* C-K] and ginsenoside Mc [*20(S)-protopanaxadiol-20-O-α-L-arabinofuranosyl(1→6)-β-D-glucopyranoside*], the structure of C-K and ginsenoside Mc were elucidated on the basis of NMR spectral data. The results of inhibition growth on rats loaded with $S_{180}$ sarcomata cell by ETP and C-K showed that the inhibition tumor rate (ITR) of ETP and C-K were 41.8% and 44.7% by ETP and C-K separately. The ant-itumor effects of ETP and C-K were very obviously.