

Nisin production in acid whey with *Lactococcus* strains

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Introduction

Acid whey, a nutritious by-product of the **fresh curd cheese production**, represents a technological challenge for further processing in the dairy industry because of its **high lactic acid content** and **bacterial load**. Therefore, acid whey is often discarded as a **biological waste**.

Objectives

We further used acid whey for the cultivation of **nisin** producing *Lactococcus* strains and additional isolation of nisin. Nisin is a very vigorous **bacteriocin**, belonging to a class of polycyclic peptide antibiotics – **lantibiotics**, and is because of its robustness highly demanded in the **food industry**.

Methods

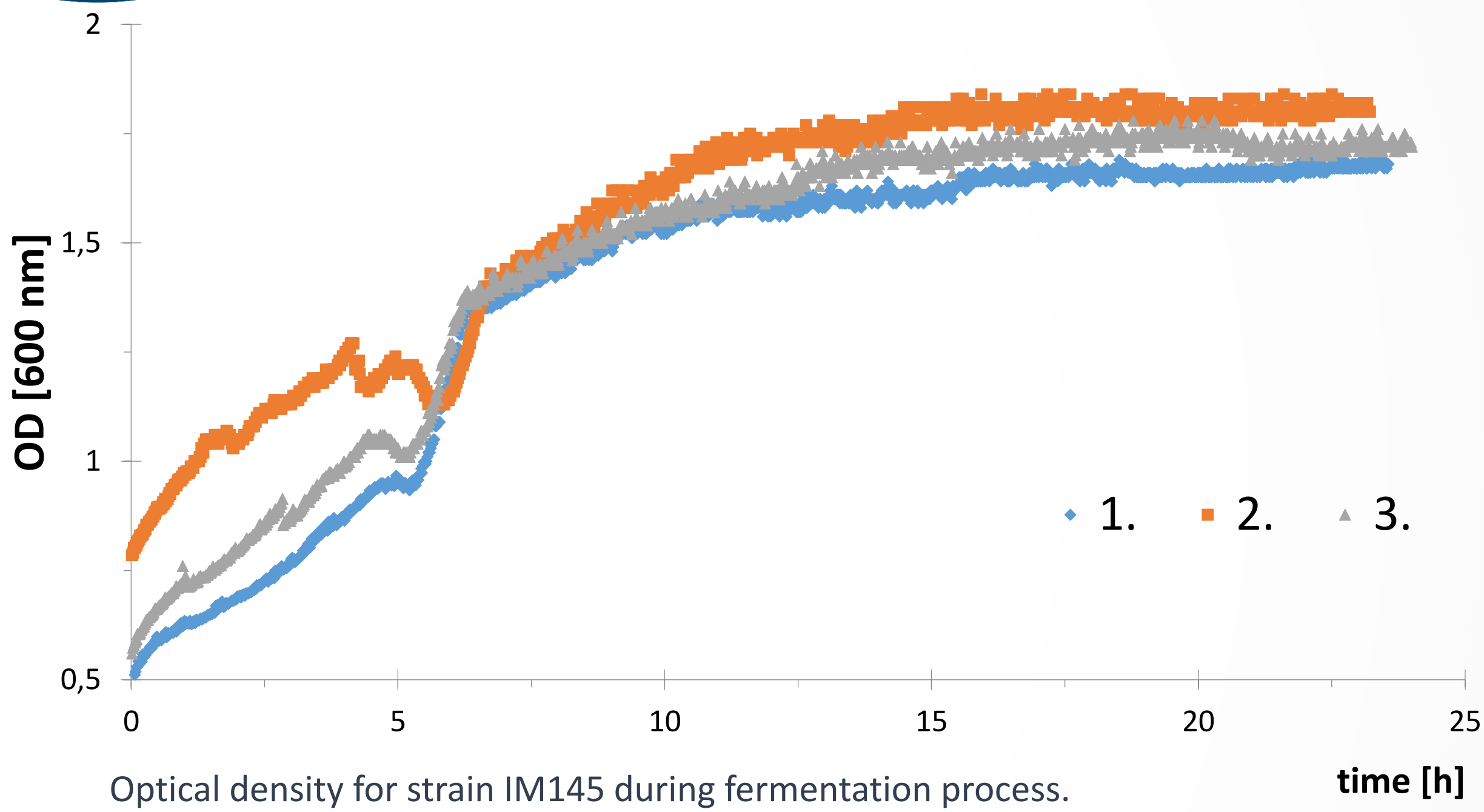
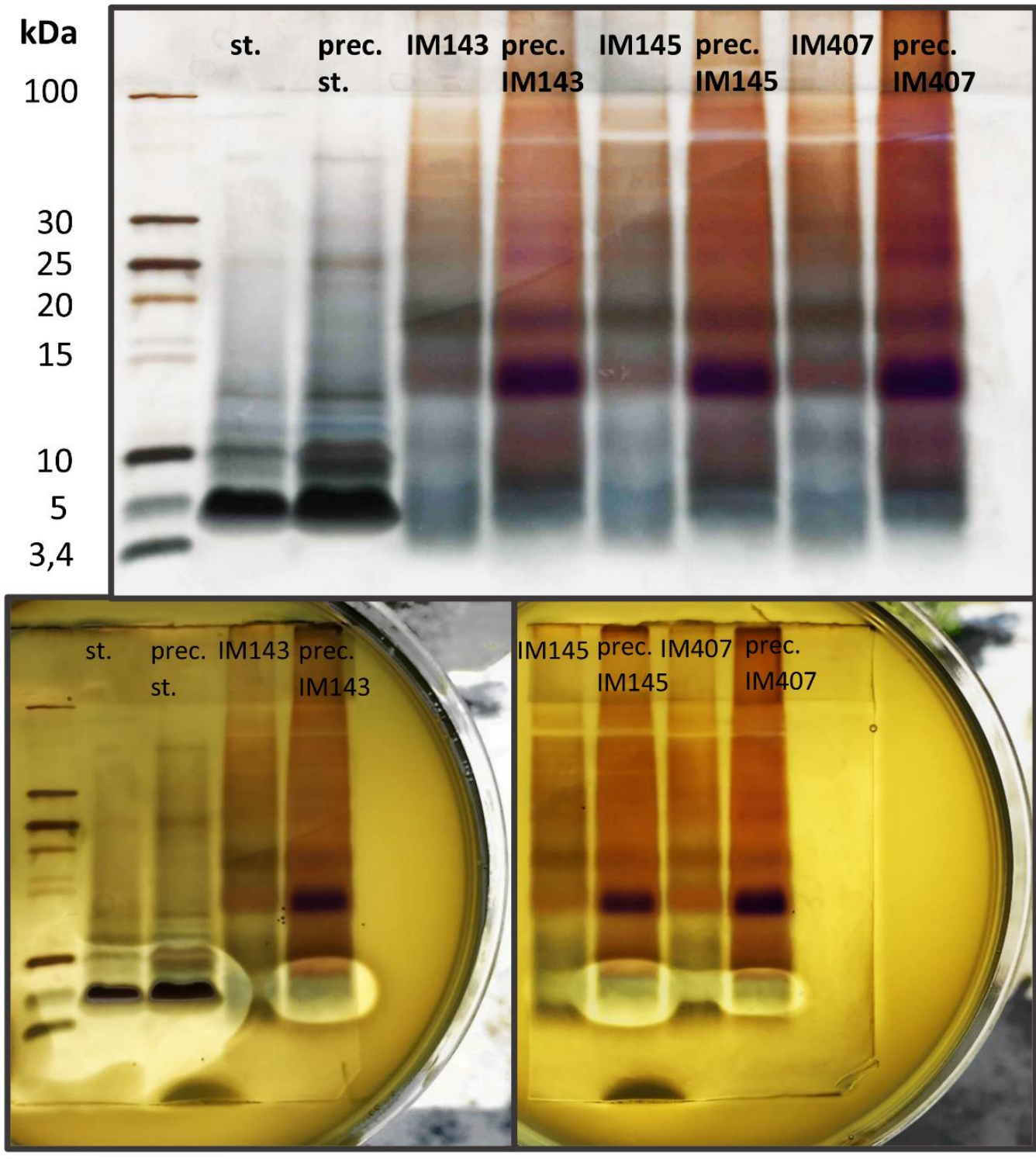
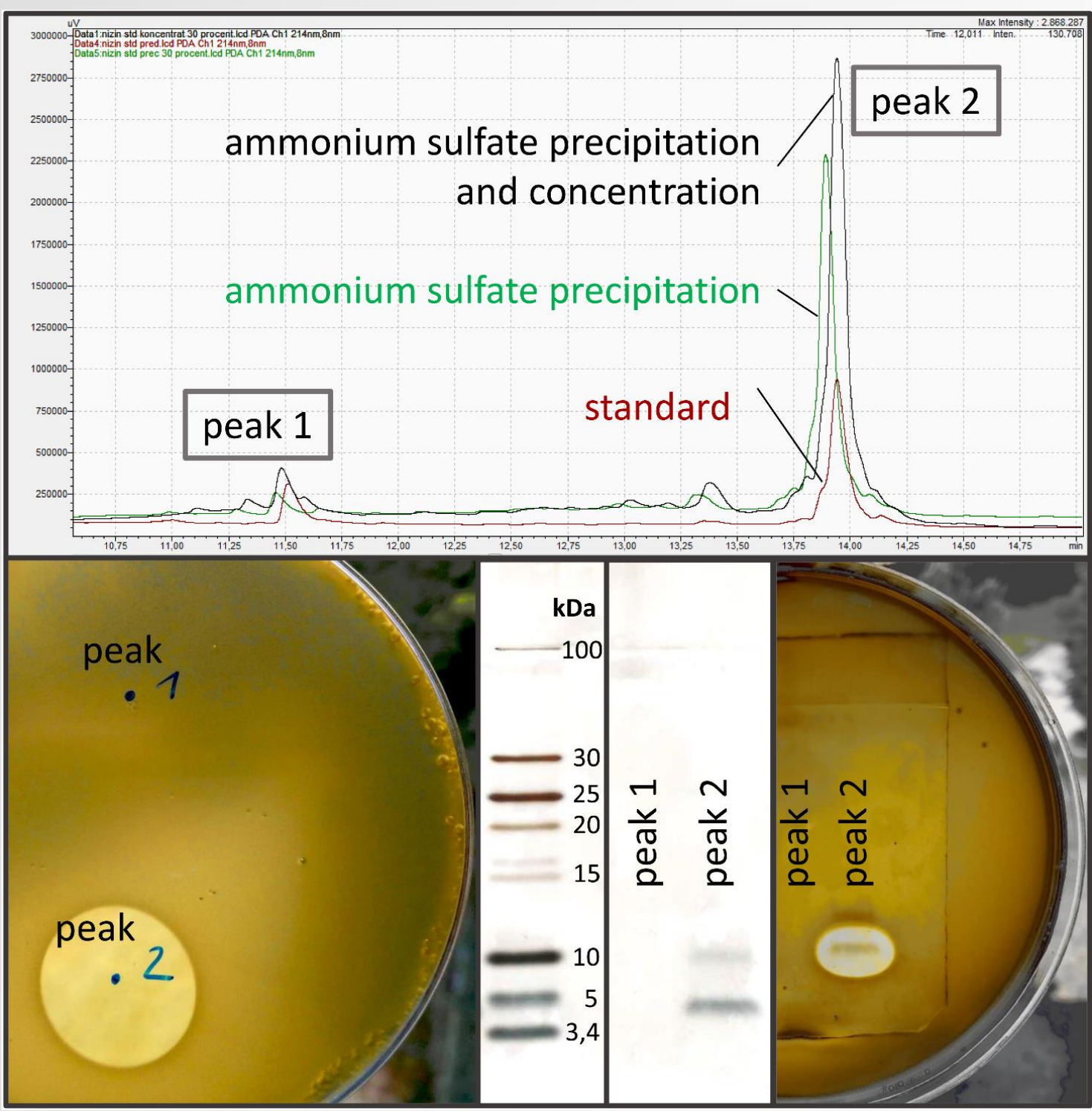
Our own isolates from sour milk, were inoculated into **enriched** (yeast extract, mineral salts), **neutralized** and filter-sterilized or autoclaved **acid whey**. After incubation, nisin was semi-purified and monitored for abundance and purity with SDS-PAGE or HPLC. **Antimicrobial activity** against the indicator strain *Lactobacillus sakei* ATCC 15521 was also determined.

Results

Lactococcus strains were cultivable in whey without additional supplements and were able to produce **nisin**, but the growth and amount of nisin was improved when **yeast extract** was included in the medium. We were able to concentrate nisin with ammonium sulfate **precipitation** and optimized detection with SDS-PAGE and RP-HPLC. We up-scaled production process in 2.5 L **bioreactors**.

Conclusions

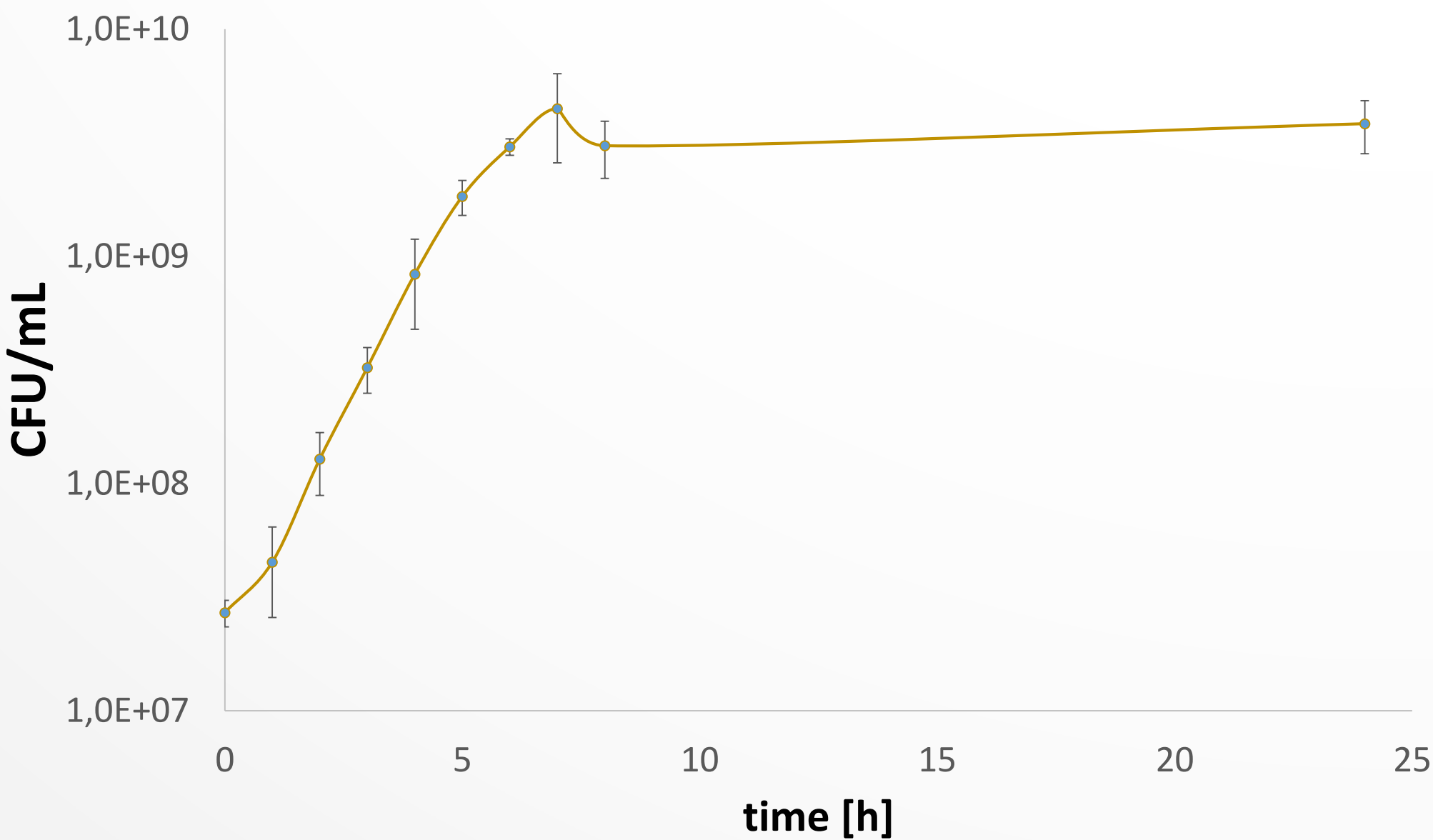
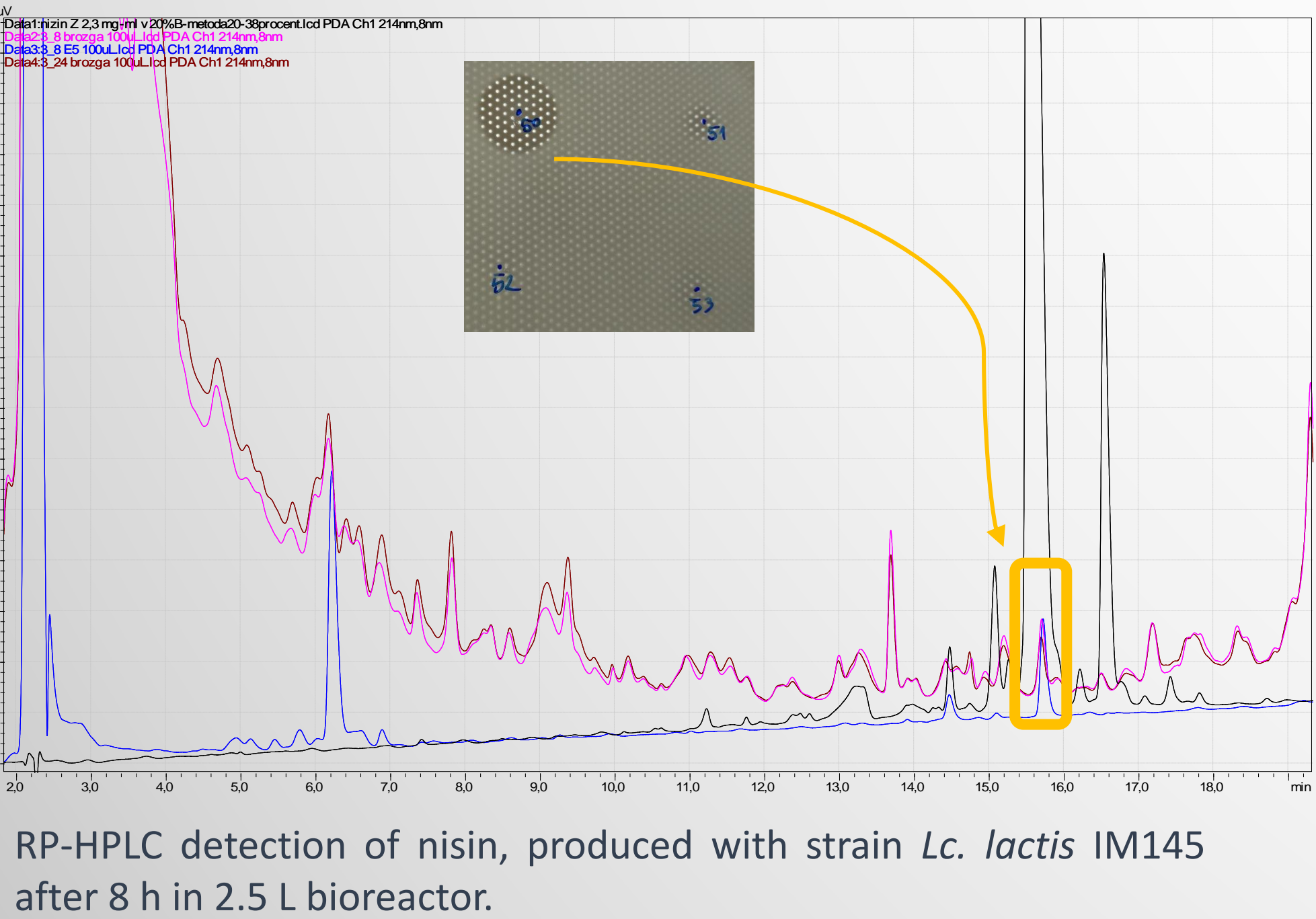
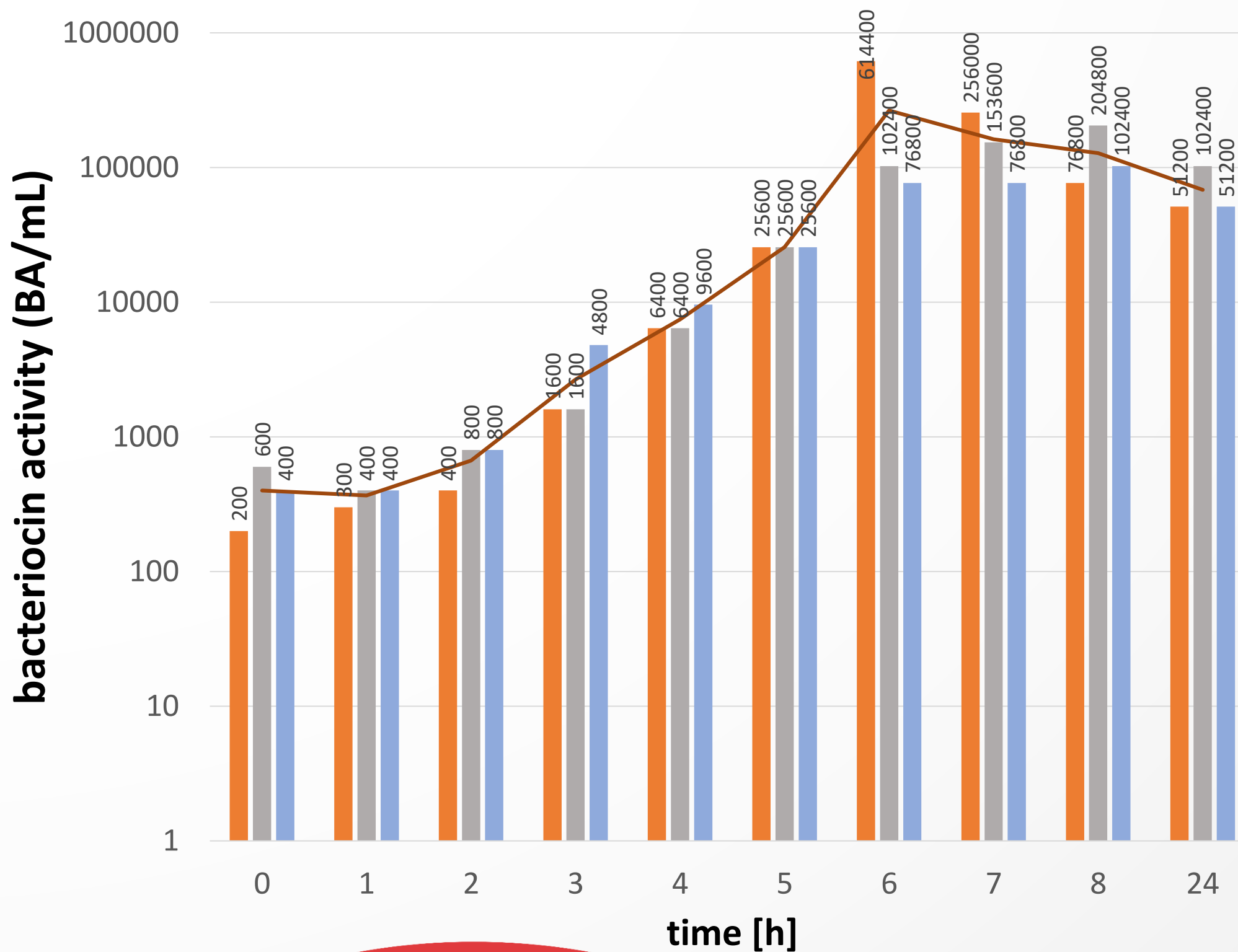
Subsequent use of acid whey for the nisin production represents an **alternative approach** in the dairy waste treatment and helps in the **reduction of environmental burden**.



Antimicrobial activity and detection of the nisin standard, before and after precipitation and concentration, on a RP-HPLC system. SDS-PAGE electrophoresis was performed on the collected fractions from the RP-HPLC analysis. Antimicrobial activity was observed in fraction that contained peak 2.

Antimicrobial activity and SDS-PAGE electrophoresis – detection of nisin before and after precipitation. Nisin was obtained by fermentation of whey with strains *Lc. lactis* IM143, *Lc. lactis* IM145, *Lc. lactis* IM407. St. – standard, prec. – precipitation.

Determination of bacteriocin activity (BA) for nisin, obtained in bioreactor with strain IM145. BA was determined each h until stationary phase.



Determination of bacterial yield for strain IM145 during fermentation process in bioreactor. Standard deviation is shown for 3 biological replicates.

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