



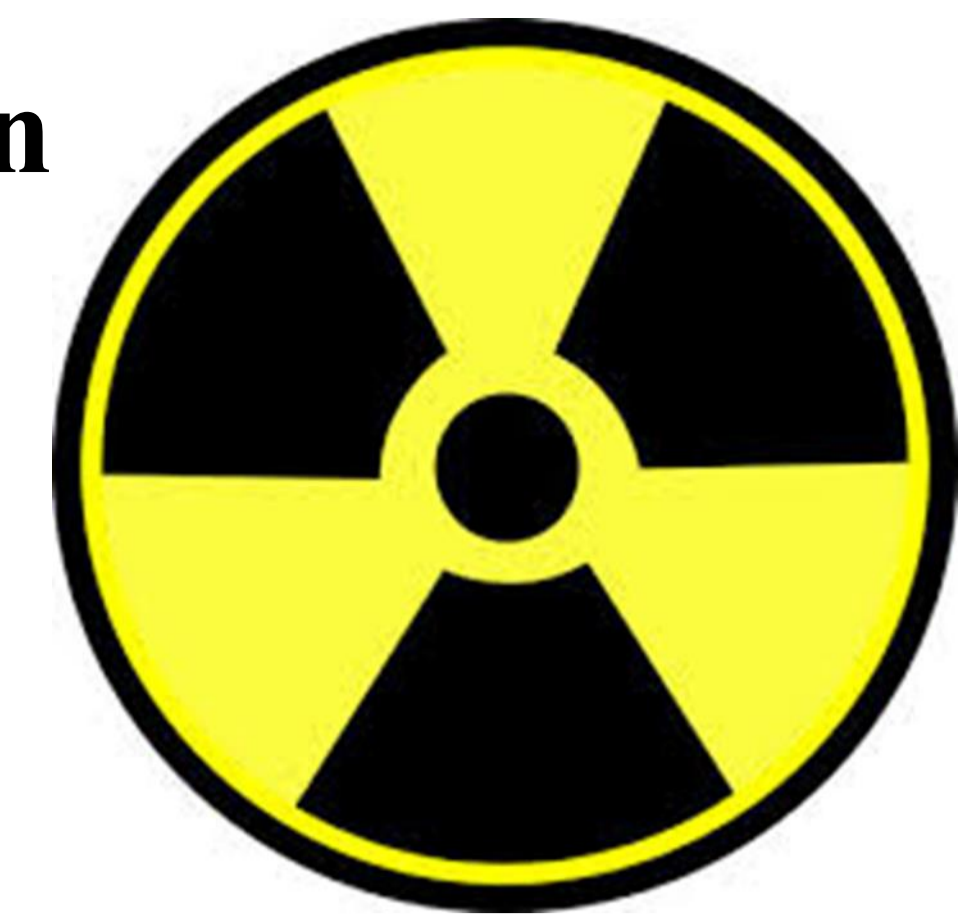
# Investigation of the sorption of $^{241}\text{Am}$ by natural minerals for water purification

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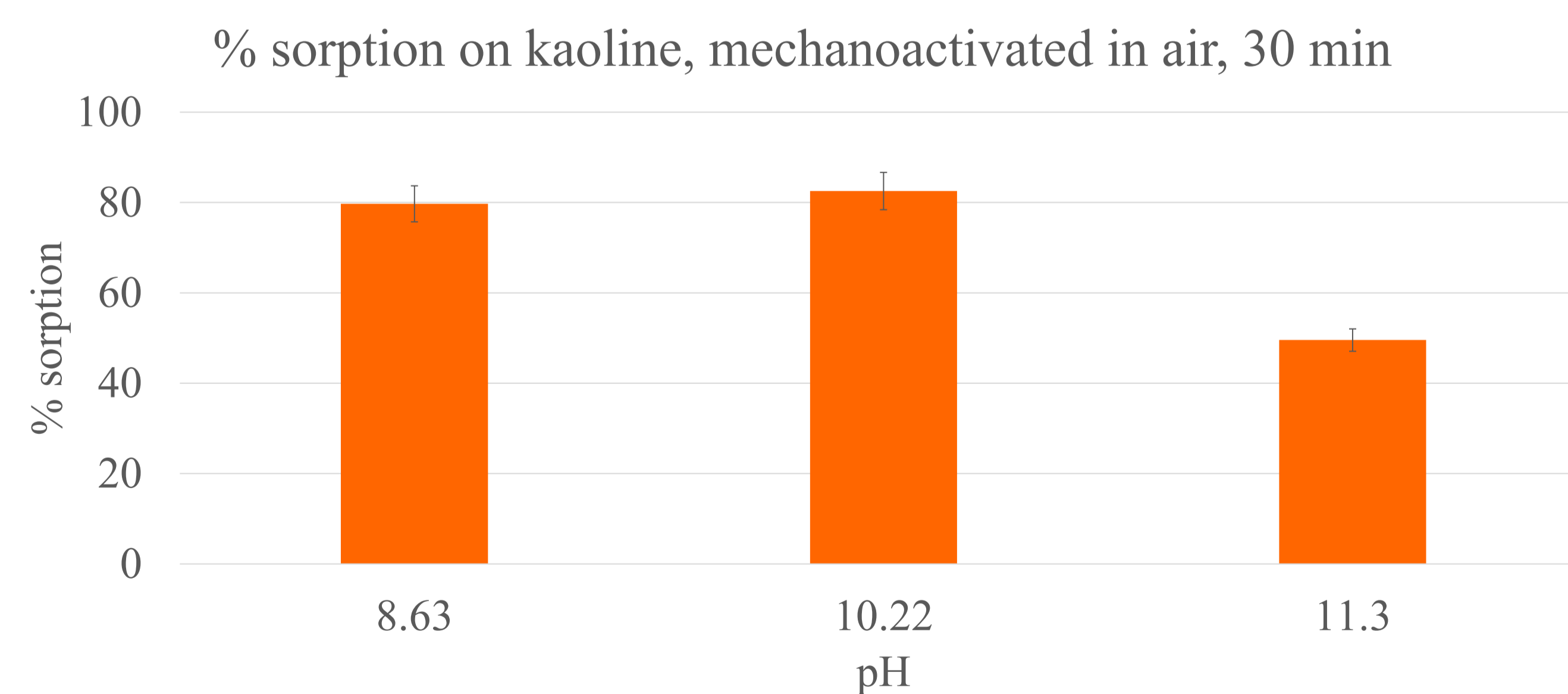
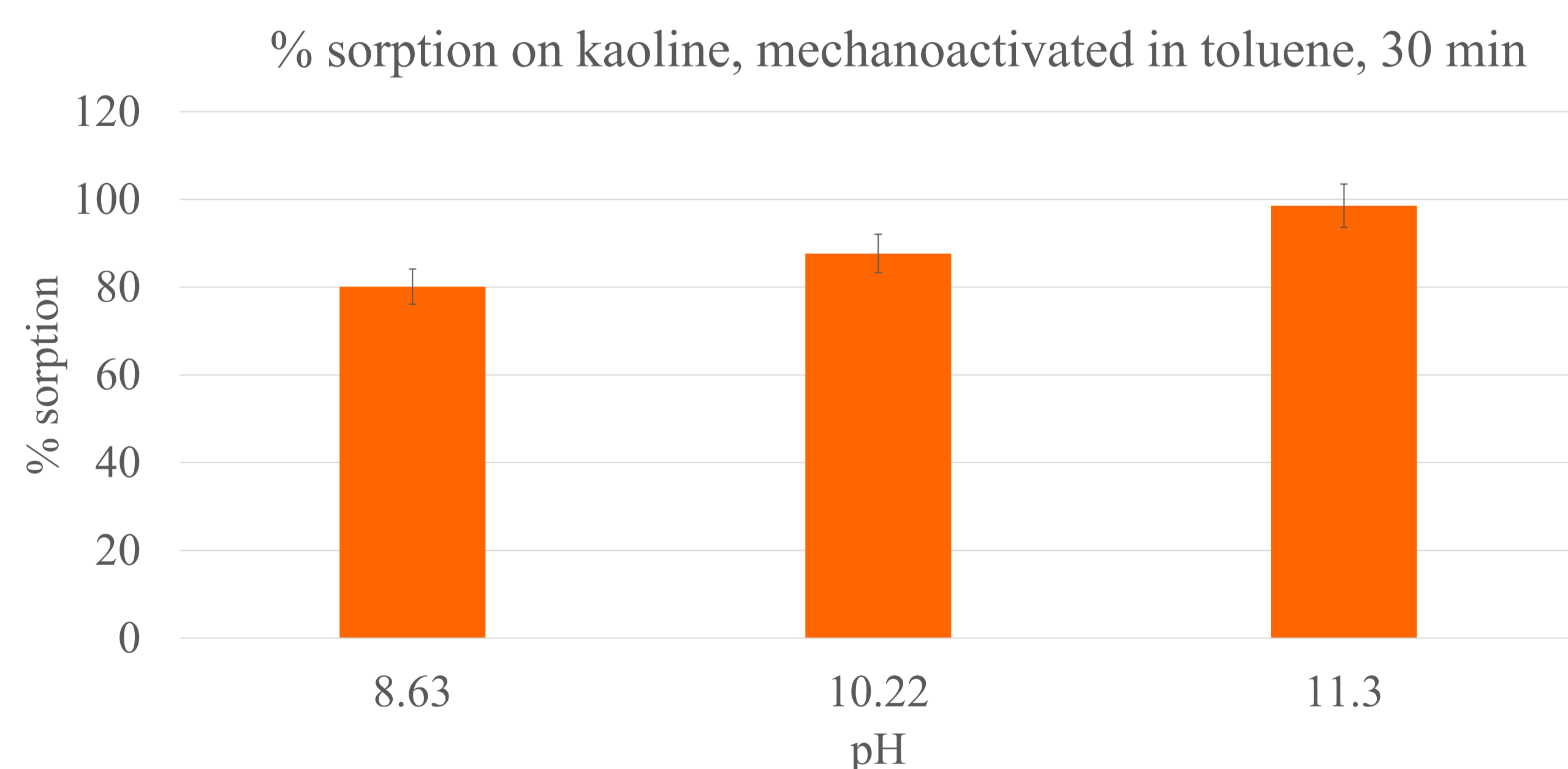
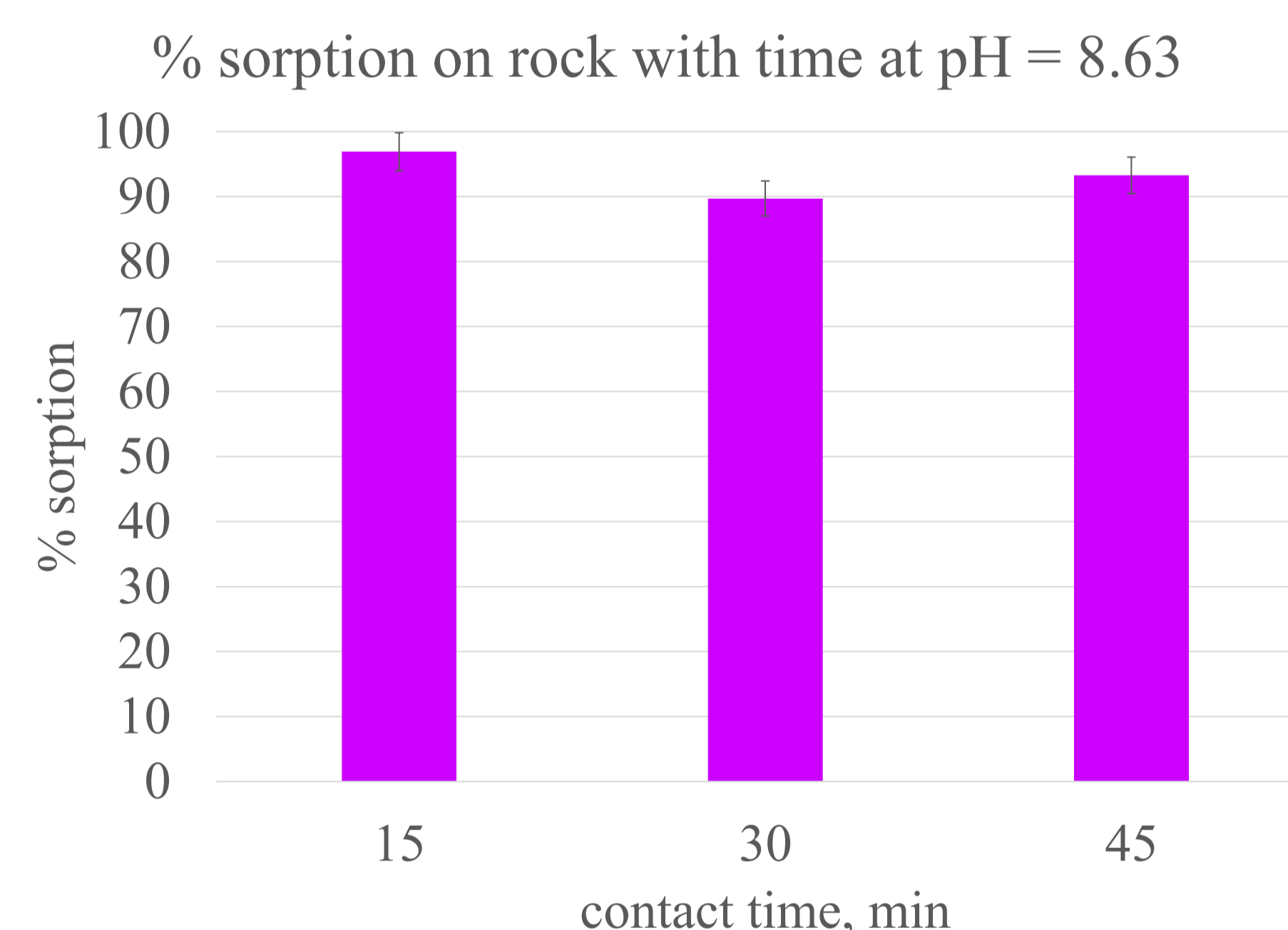
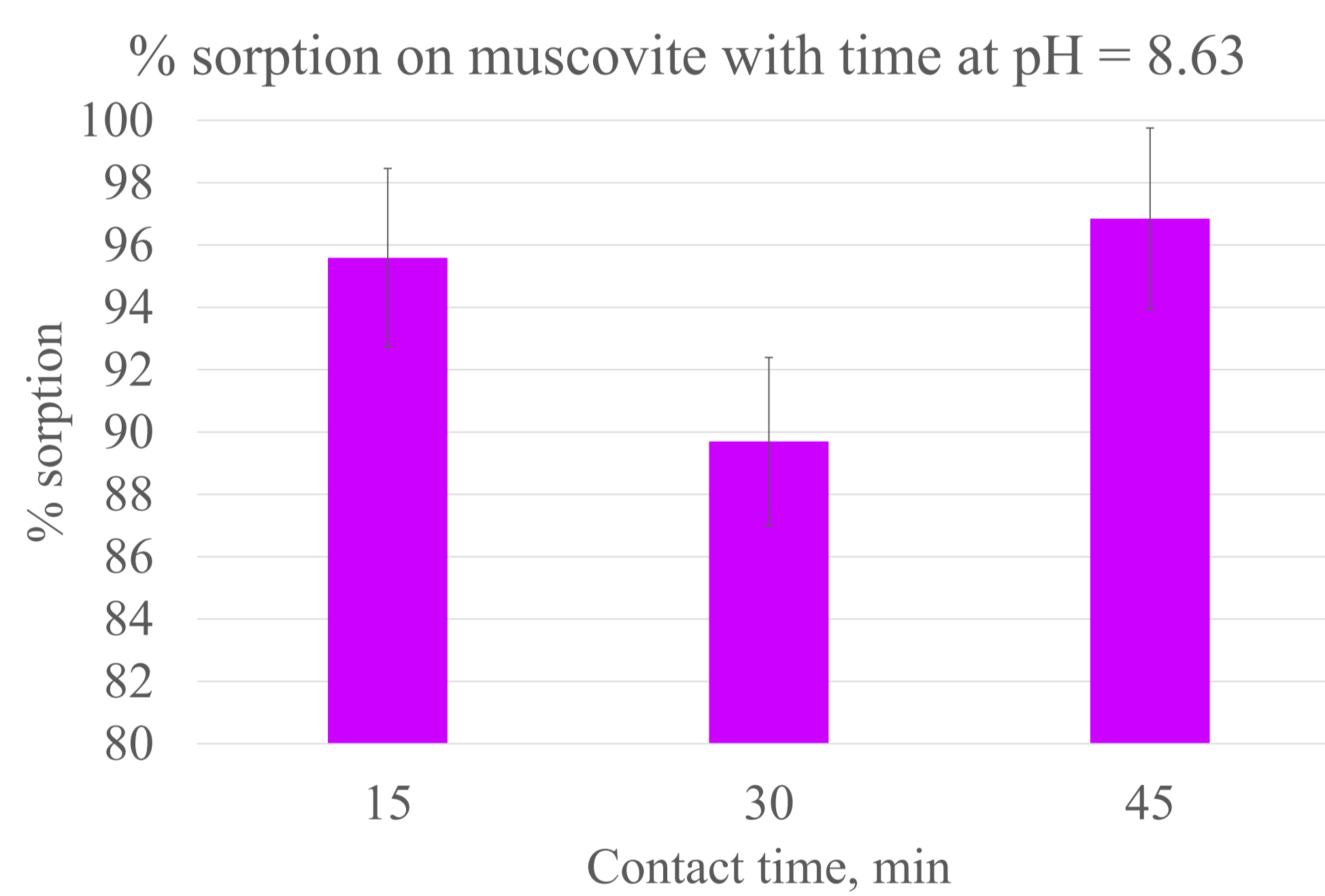
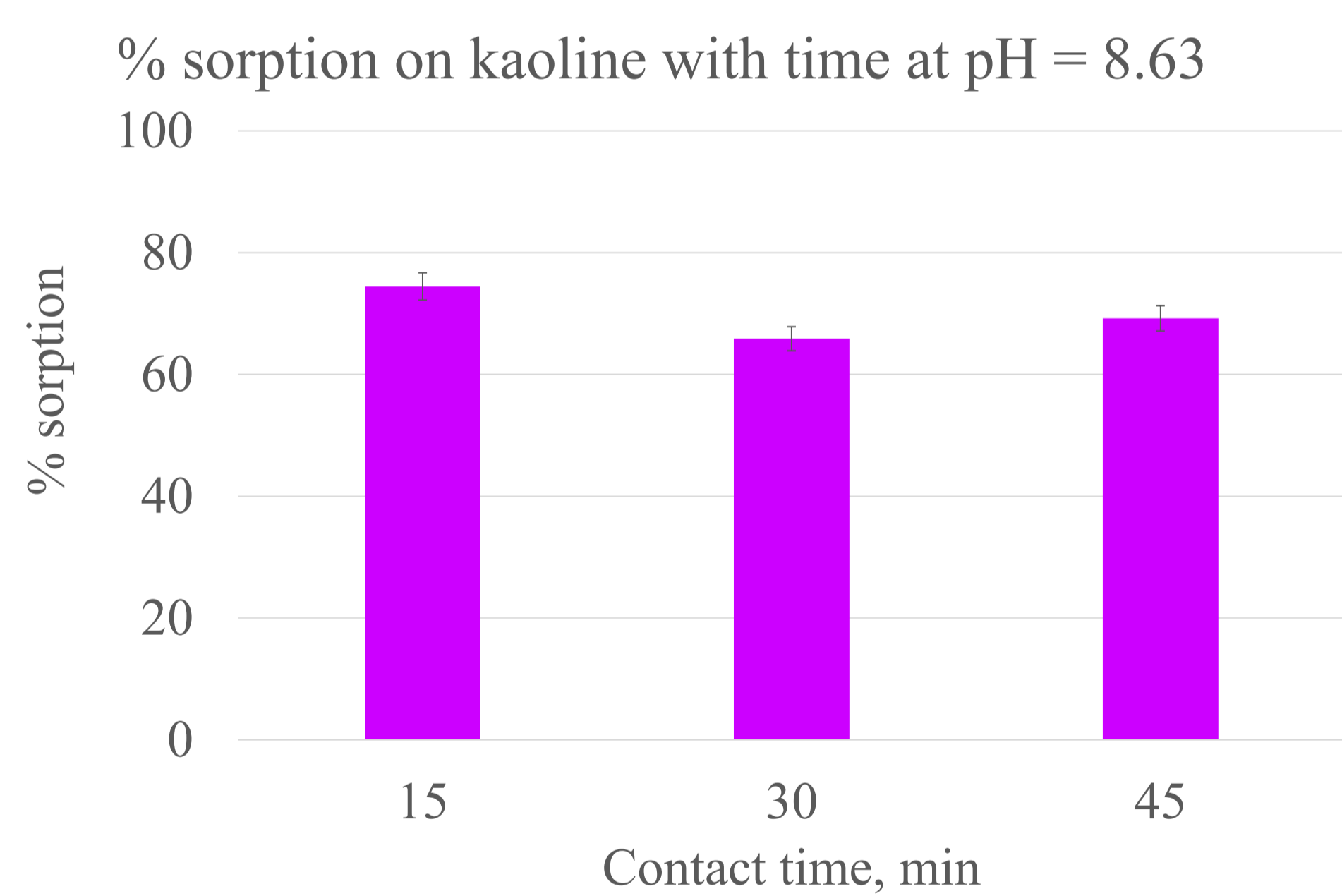
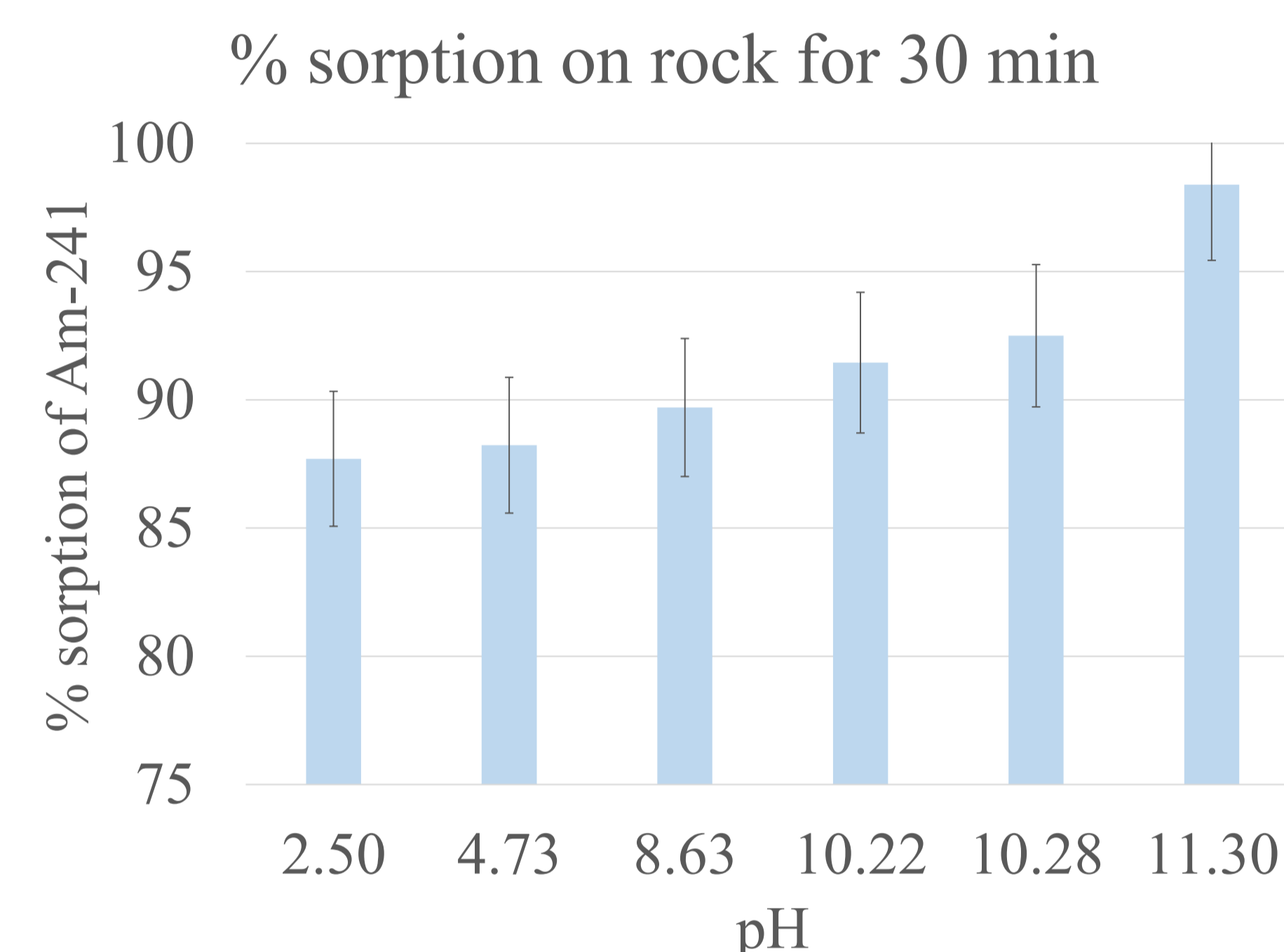
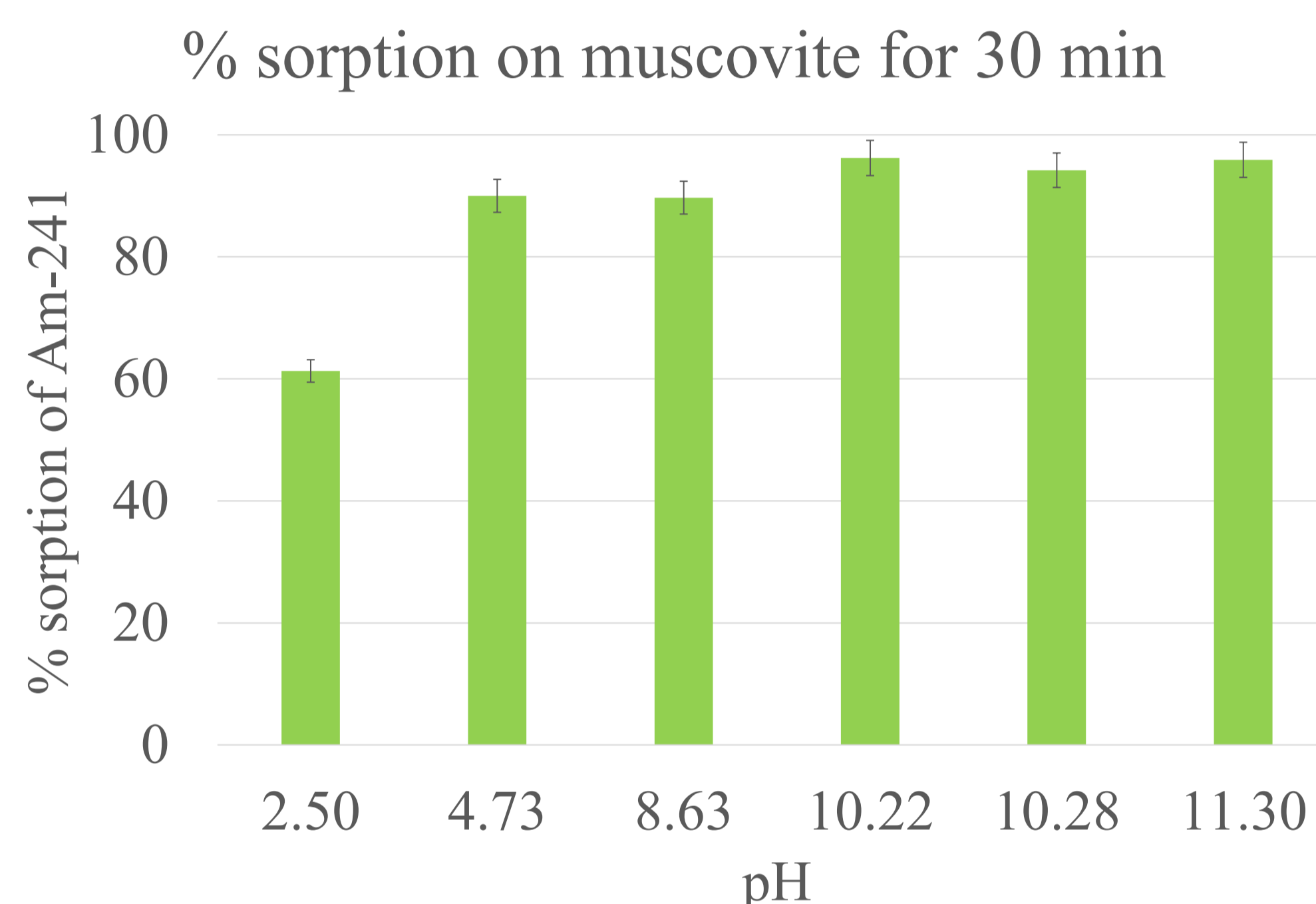
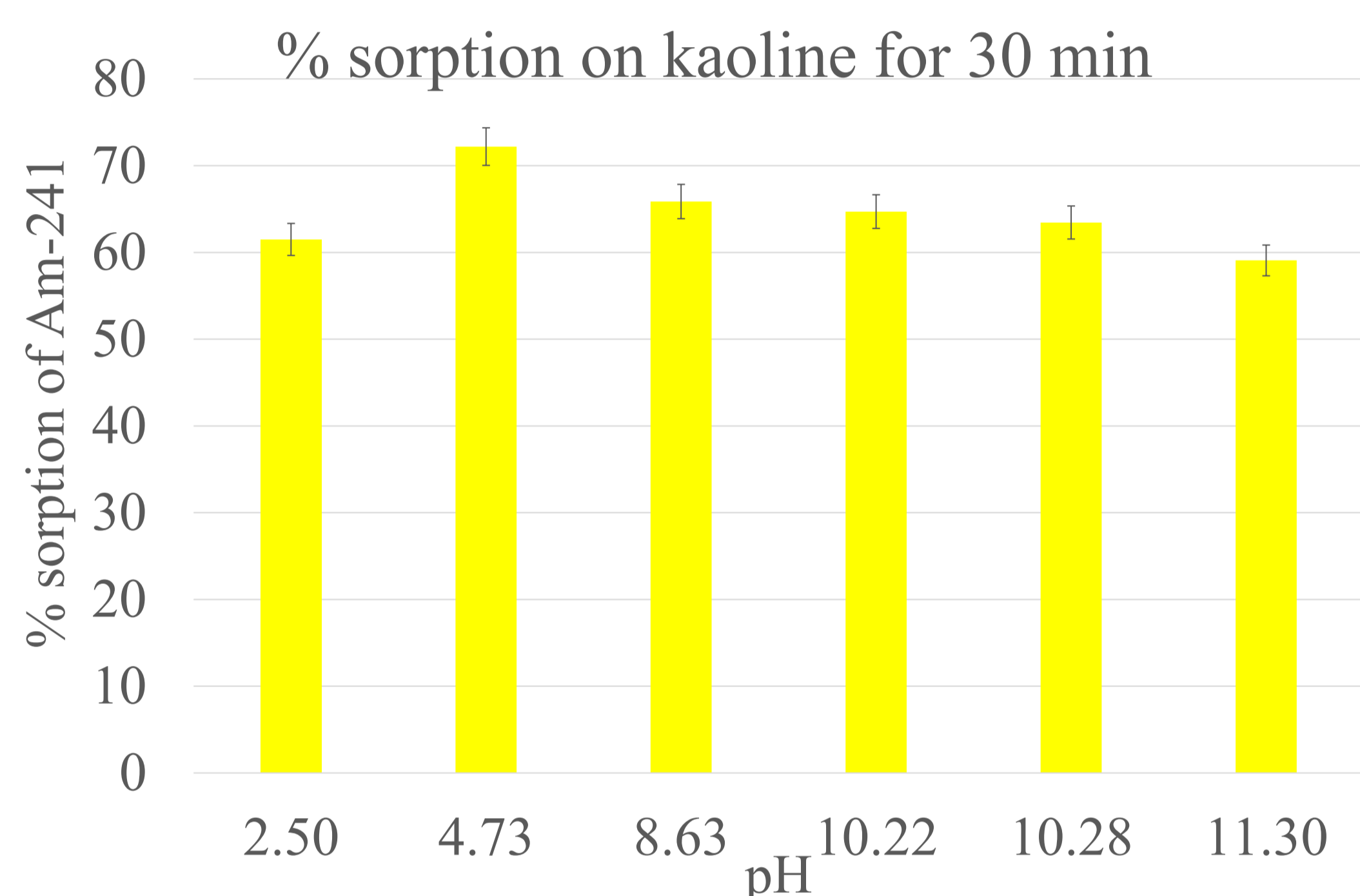


## SUMMARY

The study presents the effectiveness of natural sorbents, such as kaolinite, muscovite and rock, for the purification of water contaminated with americium across a wide pH range for a contact time from 15 to 45 min.  $^{241}\text{Am}$  has a half-life of 432.2 years and  $\alpha$ -emission, and poses a serious threat to the environment due to its high radiotoxicity and long-term mobility in natural waters. In the context of potential contamination from nuclear incidents or waste, studying its sorption onto natural minerals and modified surfaces is critically important for developing effective remediation strategies. Particularly relevant are natural clays such as kaolinite ( $\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4$ ) and micas like muscovite ( $\text{KAl}_2(\text{AlSi}_3\text{O}_{10})(\text{OH})_2$ ), as well as their mixtures with other minerals, since they are widespread in soils and groundwater in Bulgaria and globally. This study aimed to evaluate the sorption efficiency of muscovite, kaolinite and mineral mixtures for  $^{241}\text{Am}$  in contaminated waters in acidic, neutral and alkaline media. Mechanochemical activation of kaolinite in different media aiming to increase its sorption efficiency, was performed in planetary ball mill. Measurements of  $^{241}\text{Am}$  were performed by gamma-spectrometer Canberra 7221 coupled to a 16000-channel analyzer DSA-1000 with HPGe detector, using its gamma line at 59.9 keV. The mineral composition of the studied rock was determined by a Siemens D500 powder X-ray diffractometer, using  $\text{CuK}\alpha$  radiation filtered by a secondary monochromator (40 kV, 30 mA,  $0.05^\circ 2\theta / 2\text{ s}$ ) for the  $2\theta$  interval  $3\text{--}60^\circ$ . Quantitative processing of the diffractograms and identification of the mineral phases were carried out using the X'Pert HighScore Plus software.

## RESULTS AND DISCUSSION

The natural rock is composed mainly of muscovite chromian (79.2%), with significant amounts of chlorite (10.2%), quartz (11.1%), and albite (9.5%).



**CONCLUSION:** The results showed that  $^{241}\text{Am}$  sorption on kaolinite remains relatively stable between 59% and 72% across the pH range 2.5–11.3. The retention of  $^{241}\text{Am}$  on muscovite increased from 61% at to 97% while raising pH from acidic to alkaline. Mechanochemical activation of kaolinite significantly enhanced its sorption efficiency for  $^{241}\text{Am}$ , reaching to 99-100 % in alkaline media.

**Acknowledgements:** This research was performed by the financial support of the Sofia University Fund, Contract № 80-10-23/01.04.2026, entitled: Ecologically compatible natural and modified minerals and mineral mixtures for water purification and remediation of soils contaminated with Am-241 and Cs-137.