

## EXTREMOPHILES FROM UNIQUE ECOSYSTEMS OF KAZAKHSTAN

### AS POTENTIAL PRODUCERS OF NOVEL ANTIBIOTICS

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**Introduction:** Antimicrobial resistant pathogens that cause healthcare-associated infections (HAI) pose serious challenges to healthcare Institutions. ESKAPE bacterial pathogens (*Enterococcus faecium*, *Staphylococcus aureus*, *Klebsiella pneumonia*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, and *Enterobacter* spp.) are drug resistant HAI bacterial pathogens that pose the most threat globally and in Kazakhstan. Thus, there is an urgent need for discovery of new and efficacious drugs. Actinomycetes bacterial strains are the main producers of currently used antibiotics, including streptomycin, tetracycline, lincomycin, and others. Microorganisms that exist in extreme environment such as high salt or alkalinity known as extremophiles include Actinomycetes species. The goal of this study is discover novel antibiotics from Kazakhstan against ESKAPE pathogens from actinomycetes grown in extreme conditions by selecting active extracts for antibacterial activity. This will be followed by further analysis for chemical characterization and compound identification

**Methods:** Soil from extreme environments of Kazakhstan was collected and cultured for isolation of pure cultures of Actinomycetes species. Pure strains of Actinomycetes were then cultured in modified Bennett's broth containing either high salt or high pH to mimic extreme environment in soil. Antimicrobial compound was extracted with butanol and tested for activity against *S.aureus* and *E.coli*. After this screening, disk diffusion assay was performed to assess the inhibitory activity of the extracts against hospital strains of ESKAPE pathogens.

**Results:** A total number of 5936 strains were isolated from variants of modified Bennett's agar; from these, 2019 strains of extremophile actinomycetes were further isolated into pure culture (756 strains from Northern Kazakhstan and 1263 strains from Southern Kazakhstan). Of these, 415 actinomycetes strains were chosen and analyzed based on their ability to show antibacterial inhibitory activities. Zones of inhibition for *A. baumannii*, *S. aureus*, and *E. faecium* were detected when these organisms were grown in the presence of some of these extracts.

**Conclusion:** From screening a few hundred extremophile strains, we identified some interesting candidate extracts with putative antibacterial activities against several Kazakhstan hospital strains of ESKAPE pathogens. Initial chemical characterization of the extracts was performed using HPLC and showed promising results. These extracts are being further investigated for their specific therapeutic potential as novel antimicrobial.