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Impact of increasing temperature on the microenvironment of a cyanobacterial mat from extreme environment

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We investigated the effect of increasing temperature (from 25˚C to 60˚C) on oxygen and sulfide cycling using O_2, pH and H_2S microsensors in a cyanobacterial mat collected freshly from the intertidal coastal flats of Abu Dhabi, UAE. These mats are exposed to high temperatures, reaching ca. 55˚C in summer, and experience a daily fluctuation of salinity due to tidal regime and high evaporation rates. The study was performed using the winter mat, which had a salinity of 20% and a water temperature of 30˚C at the time of sampling. The results showed that oxygen production in the light was maximum at 35˚C, i.e. close to the *in situ* temperature. Oxygen penetration in the mat decreased from 3.5mm to 2mm with increasing temperature. The oxygen profile at 50˚C showed complete inhibition of photosynthesis. Dark oxygen profiles did not change significantly at different temperatures. Sulfide production was clearly enhanced by increasing temperature both in the light and in the dark with a maximum production of ca. 10mM at 50˚C. At 60˚C, sulfide production decreased suddenly to rates measured at 35˚C rates. The pH decreased in the dark from 7.4 to 6.7 and this decrease was enhanced with temperature to reach 6.2 at 50˚C. In the light, the pH increased due to photosynthesis till 45˚C but the pH profile at 50˚C was similar to the dark profile confirming that photosynthesis was inhibited at this temperature. Our data demonstrate a high adaptation of the studied mats to elevated temperatures as well as the prominent influence of temperature in the regulation of mat metabolic processes.