From Greenhouse Gas to an Energy Source of the Future: New Findings on Emission and Formation of Methane

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Methane is a gas with two faces. On one hand it contributes to climate change if it is released uncontrolled into the atmosphere and on the other hand it is an important source of energy if it is produced under controlled conditions. We have shown that not only rice fields are potential sources of methane, but all agricultural soils after heavy rainfall. Based on our results we have calculated that the amount of methane with rain in Bavaria represents the methane emission of 1.2 million cows per day. The methane machine requires no absence of oxygen. It starts already with an oxygen content in atmosphere under 20%, if soils accumulate water, and with the amino acid methionine a dramatic increase in methane production is seen. During a heatwave in Germany in the summer of 2013, we detected a methane emission of about 10 ppm for irrigated soils outdoors. A detailed field study led us to hypothize that we also detected abiotic methane that is produced by soil-chemical processes. We finally reached our goal: We could show that microbes transform CO2 with an up to now unknown efficiency into methane, if they are energised. It happens in a process one call bioelectromethanogenesis. This knowledge could lead to new sustainable possibilities for the intermediate storage with renewable energy carriers and it could increase the efficiency of biogas plants significantly. Moreover, waste material carbon dioxide from combustion processes could be recycled.