Biomass burns and Desertification – Causes and Effects

M. Nüchter[1], B. Ondruschka[1], S. Bartenbach[1], L. Weissflog[2], K. Kellner[3], G. Krüger[3]

[1]Institute for Technical Chemistry and Environmental Chemistry, Friedrich Schiller University Jena, 12 Lessingstr., D-07743 Jena, Germany
[2]Section Ecotoxicology, Centre for Environmental Research Halle-Leipzig GmbH, 15 Permoserstr., D-04103 Leipzig, Germany
[3]Potchefstroom University for Christian Higher Education, School of Environmental Sciences and Development, Private bag X6001, Potchefstroom, South Africa

Biomass burns have originated on earth since the oxygen content of the atmosphere has risen above 13 vol.% and sufficient combustible material has been available. It is highly probable that huge fires with devastating effects on the environment were also not unusual in past geological periods [1].
The development of the human society, especially in the last decades, has, through industrial development, population growth and the drastically increased energy consumption connected therewith, led to anthropogenic influences of which the consequences are currently very difficult to estimate and are the theme of intensive interdisciplinary research and discussions. A big problem affecting large parts of the earth surface is the rapid spread of deserts or areas that are not suitable for agricultural purposes any longer. Basically, all countries with arid or semi-arid climates are affected by desertification.
The role played in this process by fire incidents is discussed intensively, but is still determined by many imponderables. While several ecosystems are dependent on fire, and these fires are periodically also induced by natural causes (lightning), the majority of fires are, intentionally or unintentionally, set by human doing, and so interfere with existing ecological balances. Little research has been done on the chemical reactions during and after the fire, as well as in the fume clouds, and just as little on the pollutants released and their possible influence on distant ecosystems [2].
On the basis of selected examples of grass functional types commonly occurring in southern Africa (*Eragrostis curvula, Themeda triandra, Aristida congesta*), this study has investigated the primary biomass reactions (pyrolysis and incineration) and focussed especially on the transformation of the halogen compounds naturally occurring in plants.
Preliminary results show that a part of the mainly inorganically bound existing halogens (salts) is transformed into organically bound halogens, which then reach the atmosphere in highly volatile compounds and are there subjected to further reactions and transport processes. An essential starting point of our studies was the connection between pyrolysis and incineration processes during a fire. Apart from the use of fresh and dried experimental plant samples, the reaction conditions were varied in a wider parameter to imitate natural conditions as extensively as possible. During the investigations, it was attempted to provide a detailed carbon balance as well as a complete as possible chlorine balance of the pyrolysis and incineration experiments. The resulting gases were analysed by gas chromatograph.
The presence of olefins and chlorohydrocarbon gases in the incineration and pyrolysis gases show that the formation of chlorohydrocarbons in the fume cloud as a reaction resulting from the fire is highly probable. Thereby substances are released that are able to form plant pollutants (e.g. trichloroacetic acid, TCA) in follow-up reactions and in so doing could, through long-term stress, limit the production of plant biomass and thereby hasten desertification.

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