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STUDY OF THE THERMAL DYNAMICS OF SOLAR COOKERS ON REUNION ISLAND : TECHNICS AND USES AT HOUSEHOLD AND COMMUNAL SCALES

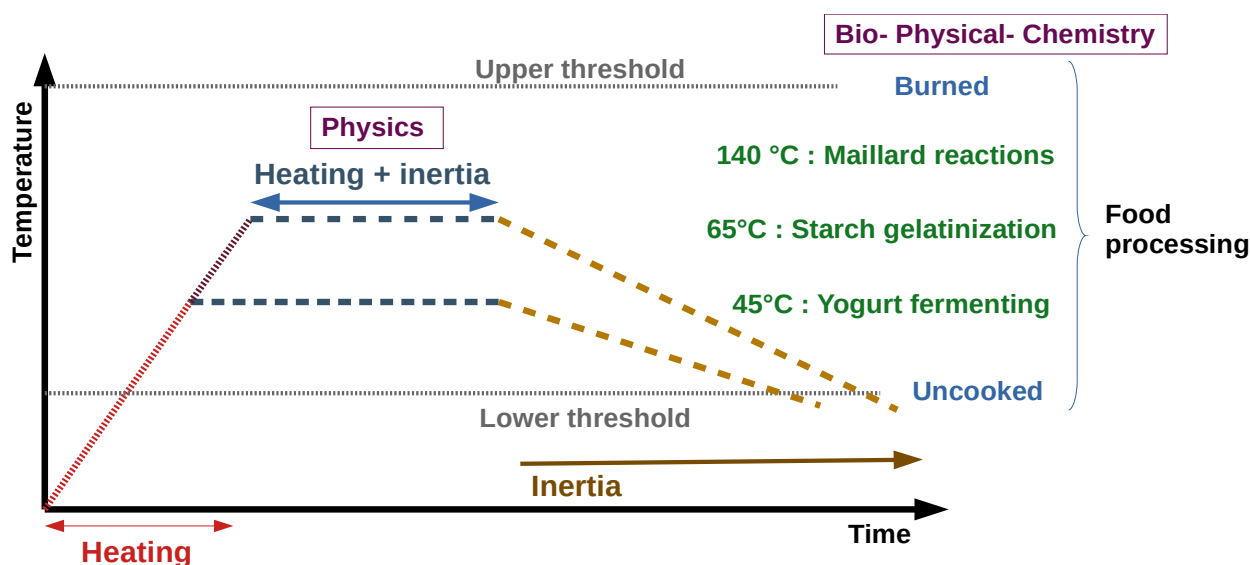
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Abstract: Within the desired framework of the overall transition of our civilization towards sustainable functioning, our study is interested in the adaptations of a modern society to solar cooking in tropical climates. Starting from the observation that the barriers limiting the adoption of solar cooking techniques are cultural before being technical, we have a contextual approach questioning both use and technique. The study setting is that of Creole cooking on the French island of Reunion located in the Indian Ocean (21° 6' 54.508" S 55° 32' 10.982" E). We identify three possible adaptations: the gesture, the recipe and the solar cooker.

By defining cooking as a journey in space, temperature as a function of time, following a map called a recipe resulting from the bio- physical- chemical properties of the ingredients and drawn by generations of previous explorers:



The objectives of this work are therefore: (i) to identify the usual cooking dynamics that can be carried out by the available solar cooking systems: adaptation of the gesture. (ii) Identify technical modifications to make the cooker more suitable for targeted use (iii) identify possible food transformations with available solar cooking systems: adaptation of the recipe.

(iv) identify the synergies between different solar or alternative cooking systems to make a particular dish - Optimize the energy consumption of these synergies.

Inspired by the techno-critical philosophy of the low-tech movement, the method used is to design solar and alternative cooking systems in a citizen laboratory by constantly questioning usage. First, the thermal dynamics $T(t)$ of all cooking systems are recorded. Then, a combined analysis of the thermal dynamics $T(t)$ and the steps of associated traditional recipes, makes it possible to identify $T(t)$ kinetic patterns that can be linked to the chemical processes of food transformation. The work on the adaptation of the gesture then consists of identifying the similarities between the $T(t)$ patterns of traditional systems and those of solar and alternative systems, in order to reconstruct a sequence of gestures with the goal of achieving the desired recipe. Also, work will be done to modify a cooker to obtain a desired $T(t)$. The work on adapting the recipe consists of comparing all the possible chemical food transformation processes and the original $T(t)$ units obtained in solar and alternative cooking systems. This allows to explore new cooking methods of the same food.

At the time of submission of this abstract, the recording of $T(t)$ dynamics and their analyzes just begun: Following a series of citizen workshops, several solar and alternative cooking systems are now available: 3 different box ovens, 1 Solar-Bro[®] tube oven, a Lytefire[®]-type solar concentrator with a set of removable targets (oven, plancha, wok) and two home-made rocket-stoves. As citizen expertise on solar cooking has been consolidated, each prototype can be modified to obtain a desired $T(t)$ kinetics. Work on adaptations, however, began at two levels: domestic and community. On the domestic front, a “rougail saucisses” for 15 people was cooked using several solar cookers and rocket-stoves. This traditional recipe involves cooking sausage, rice and beans. In this first international presentation, in order to illustrate our scientific approach, we discuss the preparation of yogurt with the use of a solar yogurt maker, as well as the comparison between electric and solar rice cooking.

At the community level, we present our project in the process of establishing a network of solar artisan bakers on Reunion Island. The approach to characterizing the links between the solar cooking tool and the user's gesture is the same as at the domestic level, but the reading of temperature dynamics at a higher level of difficulty. However, we believe that learning a gesture and using a new tool may be less difficult for a professional rather than an individual. This is why we are working with artisan bakers: the analysis of the dynamics $T(t)$ of a 28 kW artisan baker's oven made it possible to identify breads suitable for baking in our 4kW solar baker's oven, as well as interesting technical adaptations.

Keywords: Low-tech, Thermal dynamic, Solar yogurt maker, Solar rice cooker, Solar Baker, French tropical island.