



HAL
open science

Adsorption Isotherms and Isosteric Heat (qst) of the flours from three Edible Insects: *Rhynchophorus phoenicis*, *Imbrasia truncata* and *Imbrasia epimethea*

Aymar Rodrigue Fogang Mba, Germain Kansci, Catherine Loisel, Claude Genot

► To cite this version:

Aymar Rodrigue Fogang Mba, Germain Kansci, Catherine Loisel, Claude Genot. Adsorption Isotherms and Isosteric Heat (qst) of the flours from three Edible Insects: *Rhynchophorus phoenicis*, *Imbrasia truncata* and *Imbrasia epimethea*. 13. International conference of Food Physicists, Oct 2018, Antalya, Turkey. , 1p., 2018. hal-02736137

HAL Id: hal-02736137

<https://hal.inrae.fr/hal-02736137v1>

Submitted on 2 Jun 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Adsorption isotherms and isosteric heat (q_{st}) of the flours from three edible insects: *Rhynchophorus phoenicis*, *Imbrasia truncata* and *Imbrasia epimethea*

Aymar Rodrigue Fogang Mba¹, Germain Kansci¹, Catherine Loisel², Claude Genot³

1LabSAM, Département de Biochimie, Université de Yaoundé I, BP 812 Yaoundé, Cameroun

2GEPEA - UMR 6144 (CNRS), ONIRIS, 44322 Nantes, France

3UR 1268 BIA (Biopolymères Interactions Assemblages), 44316 Nantes, France

Entomophagy is practiced in many countries of the world. Edible insects are sometimes used as ingredients to formulate food products such as cookies and cakes. Prior to that, they undergo treatments such as drying and boiling, before being transformed into flour. The stability of these flours during processing, packaging and storage depends on their water content and water activity. This study evaluated the hydration properties of the flours of *Rhynchophorus phoenicis* larvae, *Imbrasia truncata* and *I. epimethea* caterpillars, insects eaten in West and Central Africa. To achieve this, insect flours were first prepared by freeze drying and grinding of the whole insects. Equilibrium adsorption isotherms, i.e. curves representing the relationship between the equilibrium moisture content and the water activity, were determined at 20, 30 and 40°C. After adjustment to 6 mathematical models (BET, GAB, SMITH, HASLEY, OSWIN and PELEG), GAB model was chosen to determine the monolayer moisture content (M_0). The Clausius-Clapeyron equation was then used to estimate the net isosteric heat of sorption. Results showed that for a given temperature, water activity (a_w) increased with the equilibrium water content. Maximum water content corresponding to microbiological growth limitations ($a_w < 6$) was 5.8 g/100 g dry matter (dm) for flour of *R. Phoenicis*; 5.6 and 6.1 g/100 g dm for *I. truncata* and *I. epimethea* respectively. At 20 and 30°C, adsorption isotherms of the flour of *R. phoenicis* larvae were type III (characteristic of easy adsorption of water in monolayer, M_0), while at 40°C, it was type II (characteristic of multimolecular adsorption of water). Those of *I. truncata* and *I. epimethea* caterpillars were of type II at 20, 30 and 40°C. GAB model was able to adjust all adsorption isotherms of insect flours at all temperatures. At 30°C, the M_0 of *R. phoenicis* larvae flour was 4.5 g/100 g flour; those of *I. truncata* and *I. epimethea* larvae were respectively 3.7 and 3.6 g/100 g. The highest net isosteric heat (q_{st}) values were obtained at low moisture contents indicating high water binding energy at low moisture content, characteristic of monolayer sorption: 21.0 kJ.mol⁻¹K⁻¹ for *I. truncata* flour; 7.9 kJ.mol⁻¹K⁻¹ for *I. epimethea* and 1.9 kJ.mol⁻¹K⁻¹ for *R. phoenicis* larvae flour. In conclusion, the studied insect flours must have water content between 2 and 5.6 g/100 g flour to be stored at 20, 30 and 40°C without risk of chemical, microbiological or enzymatic alterations.

Keywords: *Rhynchophorus phoenicis*, *Imbrasia truncata*, *Imbrasia epimethea*, adsorption isotherms, isosteric heat, flours, monolayer sorption