

MW SPECTROSCOPY COUPLED WITH ULTRAFAST UV LASER VAPORIZATION: RIBOSE FOUND IN THE GAS PHASE

EMILIO J. COCINERO, PATRICIA ECIJA, FRANCISCO J. BASTERRETxea, JOSÉ A. FERNÁNDEZ, FERNANDO CASTANO, *Departamento de Química Física, Facultad de Ciencia y Tecnología, Universidad del País Vasco (UPV-EHU), Ap. 644, E-48080 Bilbao, Spain*; ALBERTO LESARRI, *Departamento de Química-Física y Química Inorgánica, Facultad de Ciencias, Universidad de Valladolid, E-47011 Spain*; JENS-UWE GRABOW, *Institut für Physikalische Chemie, Lehrgebiet A, Universität Hannover, Callinstraße. 3A, D-30167 Hannover, Germany*.

Sugars are aldoses or ketoses with multiple hydroxy groups which have been elusive to spectroscopic studies. Here we report a rotational study of the aldopentose ribose. According to any standard textbook aldopentoses can exhibit either linear forms, cyclic five-membered (furanose) structures or six-membered (pyranose) rings, occurring either as α - or β - anomers depending on the orientation of the hydroxy group at C-1 (anomeric carbon). β -Furanose is predominant in ribonucleosides, RNA, ATP and other biochemically relevant derivatives, but is β -furanose the native form also of free ribose? Recent condensed-phase X-ray^a and older NMR^b studies delivered conflicting results. In order to solve this question we conducted a microwave study on D-ribose that, owing to ultrafast UV laser vaporization^c, has become the first C-5 sugar observed with rotational resolution. The spectrum revealed six conformations of free ribose, preferentially adopting β -pyranose chairs as well as higher-energy α -pyranose forms. The method also allowed for unambiguous distinction between different orientations of the hydroxy groups, which stabilize the structures by cooperative hydrogen-bond networks. No evidence was observed of the α -/ β -furanoses or linear forms found in the biochemical derivatives.

^a i) D. Šišak, L. B. McCusker, G. Zandomenighi, B. H. Meier, D. Bläser, R. Boese, W. B. Schweizer, R. Gylmour and J. D. Dunitz *Angew. Chem. Int. Ed.* **49**, 4503, 2010. ii) W. Saenger *Angew. Chem. Int. Ed.* **49**, 6487, 2010.

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^c E. J. Cocinero, A. Lesarri, P. Écija, F. J. Basterretxea, J. U. Grabow, J. A. Fernández and F. Castaño *Angew. Chem. Int. Ed.* in press: DOI: 10.1002/anie.201107973, 2012.