

## Supplementary Materials

### Additions to the methodology section

**Choice of the electronic state for the initial reactant structure.** The choice of describing the initial complex with a neutral charge and associated to a spin multiplicity of 2 arises from the analysis performed in a previous work (see S. Fiorucci, J. Golebiowski, D. Cabrol-Bas, S. Antonczak, *ChemPhysChem*, **2004**, 5, 1726-1733). In this study, we have shown that the characterization of this initial intermediate in a spin state multiplicity of 4 leads to a complex less stable in energy than the corresponding one, when a 2 spin state multiplicity is chosen. The same result is found for the characterization of the TS1 stationary points. Here, only the doublet spin state is thus presented, according to the fact that no avoided crossing section occurs in the course of the reaction mechanism.

However, this choice leads to initial molecular structures (denoted RI in the manuscript) in which the spin density is not associated to a single electron localized in single spinorbital. Indeed analysis of atomic spin densities for these intermediates show two single electrons localized in two  $\alpha$  molecular orbitals while a third one is localized in a  $\beta$  molecular orbital, leading then to an overall 2 spin state multiplicity. This point explains the high negative values of atomic spin densities found in these initial complexes. However, as soon as the covalent bond is in formation (TS1), the atomic spin densities are mainly localized in a single  $\alpha$  molecular spinorbital. This trend is also found for I1 intermediates and a fortiori for the following successive steps of the mechanism.

**Estimation of the rotation and pyramidalisation angles.** The calculation of the angle of rotation of the B-ring with respect to the AC conjugated rings is not straightforward since pyramidalisation phenomena occurs at the C2 carbon atom in the course of the mechanism. Thus this angle was estimated as the angle between planes defined by atoms belonging to the B-ring on one hand and by atoms belonging to the C-ring on the other. Practically speaking, these values derive from the angle defined by the vector product between normal vectors of the two planes. These planes and vectors have been estimated twice for each ring by considering three atom positions by ring among 6 possible. Four angle values are produced and the average is presented here.

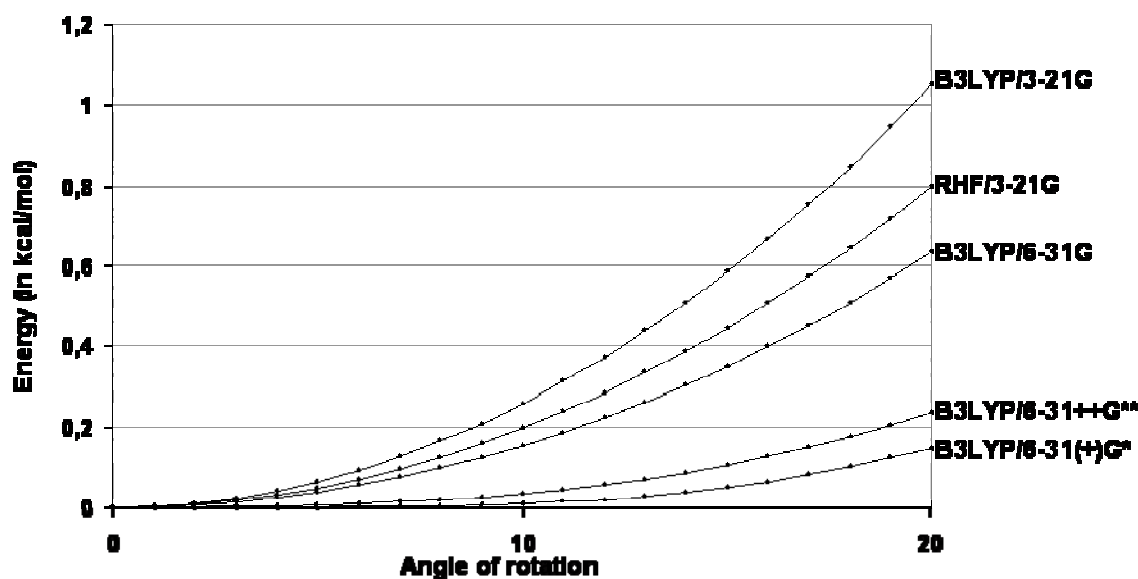
The pyramidalisation angle can be viewed as the movement of B-Ring outside the plane defined by AC conjugated rings, but it is once again dependant of a non symmetrical deformation at the O1 and C3 atoms. Thus, in addition to this value, we have also calculated this angle as the deformation at the C2 carbon atom, considered as the center of the pyramidalisation angle.

**Point Charge Calculations.** To assess the role played by amino acids constituting the binding pocket on the substrate, several frames have been chosen on the criteria that they represent the most sampled conformations of quercetin and they have been then minimized by molecular mechanics protocols. Quercetin, 22 residues, the copper center and two water molecules embedded in the cavity were then extracted from these structures. Then, quantum chemical point charge calculations were performed, considering quercetin at the B3LYP/6-31(+)G\* level. Residues constituting the active site (number 33, 35, 51, 52, 53, 63, 67, 69, 73, 74, 75, 112, 123, 132, 135, 136, 139, 163, 169, 172, 175 and 176), the metal centre and the two water molecules were considered as a background charge distribution. In the quantum chemical calculation, the substrate quercetin was considered as oxidized by the copper cation and deprotonated by GLU<sub>73</sub>.

(for more details, see S. Fiorucci, J. Golebiowski, D. Cabrol-Bass, S. Antonczak, *Molecular Simulations bring new insights into Flavonoid/Quercetinase Interaction Modes. Proteins-Structure, Function and Bioinformatics*, 67, **2007**, 961-970. )

**Energies vs Pyramidalisation and Rotation Angles.** In order to evaluate the role of the rotation of the B-ring with respect to the AC conjugated rings and the pyramidalisation at the C2 carbon atom upon the energy of the dioxygen addition, several scans have been performed. In the manuscript are presented two energy evolutions with respect to pyramidalisation at the C2 carbon atom. Considering the dashed black line, the three anchoring points, namely the two water molecules and the copper cation, have been initially placed using coordinates arising from the X-Ray structure. The complex was optimized, the three anchoring points were then frozen and the scan has been performed. This protocol can be considered as drastic with respect to the complete system, i.e. quercetin embedded in the enzyme cavity, where the substrate, the water molecules and the cation can move with respect to each others. Thus, the evolution of the energy reported here can be considered as the upper values of the deviation of the absolute energy. Note that B-ring rotation occurs when pyramidalisation is effective.

Considering the rotation, several tests have been performed, including the influence of the computational level. These are reported in the following figure that shows that the increase of the energy with respect to the B-ring rotation is limited. Thus, this result puts forward that the substrate can undergo structural deformations with a limited energy cost. Such evolutions have already been reported for quercetin and related flavonoids (see S. Antonczak, Electronic description of four flavonoids revisited by DFT method, Journal of Molecular Structure: THEOCHEM, 856, 2008, 38-45).



**Influence of the Glu amino-acid.** In order to gain deeper insight in the role of the Glu73 ligand of the copper atom, the first steps of the oxygenolysis mechanism have been characterized in the presence of a model of this amino-acid (an HCOOH molecule has been chosen). This one was placed according to the structure optimized in a previous theoretical study on the subject (see Siegbahn P.E.M. Hybrid DFT Study of the Mechanism of Quercetin 2,3-Dioxygenase, Inorg. Chem. 43, 2004, 5944-5953). However, the H atom linked to the carbon atom of this model of amino-acid has been oriented along the direction towards the place where the cation should be located. This solution was chosen to avoid strong electrostatic repulsions between oxygen atoms O3, O4 and O5 of the substrate and of this model of amino-acid. Then, four atoms were frozen in the cartesian space (two of the substrate and two belonging to the amino-acid model) and the intermediates have been characterized.

## Results

**Structures.** All the cartesian coordinates for each of the characterized stationary points (xyz text files) as well as a complete set of net atomic charges and atomic spin densities are available upon request.

**Table S1.** Free energies, together with energetic decomposition, for the creation of each intermediate from the preceding stationary point (in kcal.mol<sup>-1</sup>). Reference for TS1 is RI intermediate.

	TS1	I1	TS2	I2	TS3	I3	TS4	PDT
Galangin	6.9 / 3.3	-3.4 / -0.2	22.6 / 1.8	-5.5 / -0.4	-0.3 / 0.6	-13.0 / -1.6	1.8 / -1.2	-67.7 / -7.6
	10.2	-3.6	24.4	-5.9	0.4	-14.6	0.6	-75.3
Kaempferol	6.7 / 5.1	-2.4 / -0.4	22.4 / 1.9	-5.6 / 0.2	-0.2 / 0.6	-12.8 / -1.8	1.7 / -1.2	-68.9 / -4.7
	11.8	-2.8	24.2	-5.8	0.4	-14.6	0.5	-73.6
Quercetin	6.7 / 5.2	-2.6 / -0.4	22.3 / 1.8	-5.6 / -0.3	-0.2 / 0.5	-13.1 / -1.5	1.9 / -1.1	-68.1 / -5.3
	12.0	-3.0	24.1	-5.9	0.4	-14.7	0.8	-73.3
Myricetin	7.0 / 5.5	-2.2 / -0.5	22.4 / 1.8	-5.6 / -0.2	-0.1 / 0.5	-13.3 / -1.5	1.8 / -1.0	-67.9 / -5.6
	12.5	-2.7	24.2	-5.8	0.4	-14.8	0.8	-73.5
Morine	12.7 / 5.4	-2.6 / 0.3	22.7 / 1.1	-6.3 / -0.2	0.2 / 0.4	-12.6 / -1.4	1.9 / -0.9	-69.7 / -7.9
	18.1	-2.4	23.7	-6.5	0.6	-13.9	1.0	-77.6
Fisetin	6.0 / 5.3	-2.5 / -0.3	19.0 / 1.9	-5.5 / -0.2	-0.4 / 0.6	-13.8 / -1.6	2.0 / -0.7	-68.6 / -9.7
	11.3	-2.8	21.0	-5.7	0.2	-15.4	1.2	-78.3
Model for flavonol	3.1 / 6.1	-6.9 / 0.7	20.7 / 2.3	-5.3 / -0.6	-0.3 / 0.6	-12.2 / -2.4	1.7 / 0.1	-66.4 / -8.6
	9.1	-6.2	23.0	-6.0	0.3	-14.6	1.7	-75.0
complexed to copper	1.0 / 5.7	-0.2 / -0.3	17.7 / 1.8	0.6 / -1.2	1.8 / 0.3	-8.8 / -2.0	0.0 / -0.1	
	6.7	-0.5	19.5	-0.6	2.1	-10.8	-0.1	

b : values have been reported in ref **Error! Bookmark not defined.**

**Table S2** Transition energies (in kcal.mol<sup>-1</sup>) for each stationary point of the morin I1c intermediate formation, of quercetin H-transferred oxygenolysis and for quercetin oxygenolysis stabilized by a model of Glu73.

H-transfer in morin oxygenolysis					
	I1	TS <sub>(I1 → I1b)</sub>	I1b	TS <sub>(I1b → I1c)</sub>	I1c
ΔH / -TΔS	-	1.8 / 0.7	0.2 / -0.4	3.6 / 1.2	-8.4 / -0.8
ΔG	-	2.5	-0.3	4.7	-9.2
H-transferred quercetin oxygenolysis					
	RI <sub>H</sub>	TS1 <sub>H</sub>	I1 <sub>H</sub>	TS2 <sub>H</sub>	I2 <sub>H</sub>
ΔH / -TΔS	-	7.8 / 5.2	-2.7 / -0.2	15.9 / 1.3	-12.7 / -5.0
ΔG	-	13.0	-2.9	17.1	-17.7
Stability with respect to quercetin					
ΔG	7.2	7.4	0.3	-6.6	6.2
Quercetin oxygenolysis interacting with Glu <sub>73</sub> <sup>a</sup>					
	RI <sub>Glu</sub>	TS1 <sub>Glu</sub>	I1 <sub>Glu</sub>	TS2 <sub>Glu</sub>	I2 <sub>Glu</sub>
-TΔS	-	1.3	0.3	0.8 (3.6)	3.2 (1.0)
ΔH	-	5.7	-2.5	19.0 (12.7)	-4.3 (-13.5)
ΔG	-	7.1	-2.2	19.8 (16.3)	-1.1 (-12.5)

a) In parenthesis are given energy transition for structure where H<sub>O5</sub> is transferred onto O3 oxygen atom. I1<sub>H,Glu</sub>, TS2<sub>H,Glu</sub> and I2<sub>H,Glu</sub> are respectively 8.4, 5.0 and -6.4 kcal.mol<sup>-1</sup> less or more stable in energy than the corresponding I1<sub>Glu</sub>, TS2<sub>Glu</sub> and I2<sub>Glu</sub> structures.

**Quercetin.** Selected geometrical parameters (bond in Å and angles in degrees), atomic spin densities and sum of NPA Atomic Charges ( $\Sigma q_{AC}$ : atoms of the A and C rings;  $\Sigma q_B$ : atoms of the B ring;  $\Sigma q_{O2}$ : oxygen atom of the initial dioxygen) computed for each stationary point of the quercetin oxygenolysis mechanism.

	RI	TS1	I1	TS2	I2	TS3	I3	TS4	PDT
Geometrical parameters									
C2-Oa	3.20	1.93	1.49	1.41	1.41	1.41	1.40	1.35	1.21
C2-C3	1.45	1.50	1.57	1.59	1.58	1.58	1.58	1.89	3.60
C3-C4	1.52	1.53	1.54	1.62	1.74	1.93	3.88	3.65	4.17
C3-O3	1.24	1.22	1.21	1.18	1.18	1.17	1.18	1.16	1.14
C4-Ob	4.71	3.92	3.20	1.79	1.46	1.44	1.39	1.37	1.30
C4-O4	1.24	1.24	1.24	1.24	1.26	1.25	1.22	1.23	1.30
Oa-Ob	1.22	1.26	1.33	1.42	1.48	1.48	1.47	1.52	4.42
$\theta_{rot}$	2.4	14.1	58.2	28.0	37.9	11.4	69.0	45.2	45.4
$\theta_{1_{pyr}}$	179.5	153.6	128.7	124.3	118.1	140.0	116.1	113.5	90.9
$\theta_{2_{pyr}}$	0.3	16.1	30.0	32.3	35.8	23.1	34.3	33.3	34.1
Atomic Spin Densities									
C2	-0.38	-0.12	0.00	0.05	0.08	0.10	0.12	0.34	0.0
C3	0.00	0.00	0.00	0.09	0.16	0.26	0.55	0.29	0.0
O3	-0.31	-0.06	0.00	0.14	0.16	0.19	0.27	0.15	0.0
O4	-0.04	-0.01	0.00	0.19	0.28	0.19	0.00	0.01	0.26
Oa	0.98	0.52	0.28	0.13	0.01	0.00	0.02	0.01	0.0
Ob	0.99	0.71	0.70	0.31	0.06	0.06	0.00	0.08	0.75
Charge Distribution									
$\Sigma q_{AC}$	-0.11	0.14	0.28	0.40	0.49	0.49	0.51	0.55	0.85
$\Sigma q_B$	0.13	0.11	0.06	0.09	0.10	0.09	0.06	0.05	0.05
$\Sigma q_{O2}$	-0.01	-0.25	-0.34	-0.49	-0.59	-0.58	-0.57	-0.60	-0.90

**Galangin:** Selected geometrical parameters (bond in Å and angles in degrees), atomic spin densities and sum of NPA Atomic Charges ( $\Sigma q_{AC}$  : atoms of the A and C rings;  $\Sigma q_B$  : atoms of the B ring;  $\Sigma q_{O2}$  : oxygen atom of the initial dioxygen) computed for each stationary point of the galangin oxygenolysis mechanism.

	RI	TS1	I1	TS2	I2	TS3	I3	TS4	PDT
Geometrical parameters									
C2-Oa	3.73	1.96	1.49	1.41	1.41	1.41	1.40	1.35	1.21
C2-C3	1.45	1.50	1.56	1.59	1.58	1.58	1.58	1.88	3.59
C3-C4	1.52	1.53	1.54	1.62	1.74	1.92	3.88	3.62	4.19
C3-O3	1.24	1.22	1.21	1.18	1.18	1.17	1.18	1.16	1.14
C4-Ob	3.84	3.92	3.20	1.78	1.46	1.44	1.39	1.37	1.30
C4-O4	1.24	1.24	1.24	1.24	1.26	1.25	1.22	1.23	1.26
Oa-Ob	1.22	1.26	1.33	1.42	1.48	1.47	1.46	1.53	4.45
$\theta_{rot}$	4,71	15.80	58.81	28.34	38.28	34.85	71.13	43.97	18.73
$\theta_{1_{pyr}}$	0,43	15.32	30.06	32.33	35.81	62.25	34.51	33.35	25.1
$\theta_{2_{pyr}}$	179,30	154.84	128.61	124.26	118.09	144.11	115.68	113.40	89.9
Atomic Spin Densities									
C2	-0,41	-0,16	-0,01	0,05	0,08	0,26	0,12	0,33	0,00
C3	0,01	0,00	0,01	0,09	0,17	0,10	0,55	0,30	0,00
O3	-0,32	-0,07	0,00	0,15	0,16	0,19	0,27	0,15	0,00
O4	-0,04	-0,01	0,00	0,20	0,28	0,19	0,00	0,01	0,27
Oa	0,98	0,55	0,28	0,13	0,00	0,00	0,02	0,01	0,01
Ob	1,00	0,73	0,70	0,31	0,07	0,06	0,00	0,10	0,74
Charge Distribution									
$\Sigma q_{AC}$	-0,09	0,13	0,27	0,41	0,50	0,50	0,51	0,57	0,86
$\Sigma q_B$	0,10	0,09	0,06	0,08	0,09	0,08	0,05	0,03	0,04
$\Sigma q_{O2}$	-0,01	-0,23	-0,33	-0,49	-0,58	-0,58	-0,57	-0,60	-0,90

**Kaempferol:** Selected geometrical parameters (bond in Å and angles in degrees), atomic spin densities and sum of NPA Atomic Charges ( $\Sigma q_{AC}$  : atoms of the A and C rings;  $\Sigma q_B$  : atoms of the B ring;  $\Sigma q_{O2}$  : oxygen atom of the initial dioxygen) computed for each stationary point of the kaempferol oxygenolysis mechanism.

	RI	TS1	I1	TS2	I2	TS3	I3	TS4	PDT
<b>Geometrical parameters</b>									
C2-Oa	3.20	1.93	1.49	1.41	1.41	1.41	1.40	1.36	1.21
C2-C3	1.45	1.50	1.56	1.60	1.58	1.58	1.58	1.88	3.59
C3-C4	1.52	1.53	1.54	1.62	1.74	1.93	3.87	3.57	4.19
C3-O3	1.24	1.22	1.21	1.18	1.18	1.17	1.18	1.16	1.14
C4-Ob	4.68	3.93	3.20	1.79	1.46	1.44	1.39	1.37	1.30
C4-O4	1.24	1.24	1.24	1.24	1.26	1.25	1.22	1.23	1.26
Oa-Ob	1.22	1.26	1.33	1.42	1.48	1.47	1.46	1.52	4.45
$\theta_{rot}$	2.82	13.96	56.91	27.76	37.45	34.54	70.10	40.34	42.21
$\theta_{1_{pyr}}$	0.45	16.25	30.01	32.37	35.86	36.00	34.49	33.51	25.0
$\theta_{2_{pyr}}$	179.28	153.31	128.81	124.27	118.11	117.69	115.86	113.85	89.9
<b>Atomic Spin Densities</b>									
C2	-0.37	-0.12	-0.01	0.05	0.08	0.09	0.12	0.34	0.00
C3	0.00	0.00	0.01	0.09	0.16	0.26	0.55	0.29	0.00
O3	-0.31	-0.05	0.00	0.14	0.16	0.18	0.27	0.15	0.00
O4	-0.04	-0.01	0.00	0.19	0.28	0.19	0.00	0.01	0.27
Oa	0.98	0.51	0.28	0.13	0.01	0.00	0.02	0.01	0.01
Ob	0.99	0.71	0.70	0.31	0.06	0.06	0.00	0.08	0.74
<b>Charge Distribution</b>									
$\Sigma q_{AC}$	-0.12	0.12	0.25	0.39	0.47	0.48	0.49	0.53	0,85
$\Sigma q_B$	0.14	0.13	0.09	0.10	0.11	-0.46	0.08	0.07	0,06
$\Sigma q_{O2}$	-0.01	-0.25	-0.34	-0.49	-0.59	-0.01	-0.57	-0.60	-0,91



**Myrecitin:** Selected geometrical parameters (bond in Å and angles in degrees), atomic spin densities and sum of NPA Atomic Charges ( $\Sigma q_{AC}$  : atoms of the A and C rings;  $\Sigma q_B$  : atoms of the B ring;  $\Sigma q_{O2}$  : oxygen atom of the initial dioxygen) computed for each stationary point of the myrecitin oxygenolysis mechanism.

	RI	TS1	I1	TS2	I2	TS3	I3	TS4	PDT
<b>Geometrical parameters</b>									
C2-Oa	3.18	1.92	1.51	1.41	1.41	1.41	1.40	1.36	1.21
C2-C3	1.45	1.50	1.56	1.60	1.58	1.58	1.58	1.90	3.59
C3-C4	1.52	1.53	1.54	1.62	1.73	1.93	3.87	3.66	4.16
C3-O3	1.24	1.22	1.21	1.18	1.18	1.17	1.18	1.16	1.14
C4-Ob	4.55	3.89	3.01	1.80	1.46	1.44	1.39	1.37	1.30
C4-O4	1.24	1.24	1.24	1.24	1.26	1.25	1.22	1.23	1.26
Oa-Ob	1.22	1.26	1.32	1.42	1.48	1.48	1.47	1.52	4.41
$\theta_{rot}$	1.70	14.40	33.83	30.18	37.42	34.47	68.02	45.31	45.54
$\theta_{1_{pyr}}$	0.40	16.30	31.15	32.36	35.66	35.81	34.22	33.18	33.9
$\theta_{2_{pyr}}$	179.36	153.24	126.87	124.18	118.25	117.86	116.20	113.51	91.2
<b>Atomic Spin Densities</b>									
C2	-0.37	-0.11	-0.02	0.05	0.00	0.09	0.12	0.34	0.00
C3	-0.01	0.00	0.00	0.09	0.00	0.26	0.55	0.29	0.00
O3	-0.30	-0.05	0.00	0.14	0.00	0.18	0.27	0.15	0.00
O4	-0.04	-0.01	0.00	0.19	0.00	0.18	0.00	0.01	0.26
Oa	0.98	0.51	0.31	0.13	0.01	0.00	0.02	0.01	0.01
Ob	0.99	0.71	0.67	0.30	0.01	0.06	0.00	0.08	0.75
<b>Charge Distribution</b>									
$\Sigma q_{AC}$	-0.12	0.14	0.28	0.41	0.49	0.49	0.52	0.55	0,85
$\Sigma q_B$	0.13	0.11	0.07	0.09	0.10	0.09	0.06	0.05	0,05
$\Sigma q_{O2}$	-0.01	-0.25	-0.35	-0.50	-0.59	-0.58	-0.57	-0.60	-0,90

**Fisetin:** Selected geometrical parameters (bond in Å and angles in degrees), atomic spin densities and sum of NPA Atomic Charges ( $\Sigma q_{AC}$  : atoms of the A and C rings;  $\Sigma q_B$  : atoms of the B ring;  $\Sigma q_{O2}$  : oxygen atom of the initial dioxygen) computed for each stationary point of the fisetin oxygenolysis mechanism.

	RI	TS1	I1	TS2	I2	TS3	I3	TS4	PDT
<b>Geometrical parameters</b>									
C2-Oa	3.19	1.95	1.50	1.50	1.41	1.41	1.40	1.36	1.21
C2-C3	1.45	1.50	1.57	1.60	1.58	1.58	1.58	1.89	3.62
C3-C4	1.53	1.54	1.55	1.63	1.73	1.88	3.86	3.22	4.22
C3-O3	1.24	1.22	1.20	1.18	1.18	1.17	1.18	1.16	1.14
C4-Ob	4.72	3.93	2.98	1.80	1.47	1.46	1.39	1.38	1.28
C4-O4	1.23	1.22	1.22	1.23	1.25	1.24	1.21	1.21	1.27
Oa-Ob	1.22	1.26	1.32	1.42	1.48	1.48	1.47	1.51	1.46
$\theta_{rot}$	2.91	13.84	35.84	28.43	37.77	35.54	70.78	20.96	43.1
$\theta_{1_{pyr}}$	0.5	15.5	31.4	32.7	36.1	36.2	34.6	34.5	33.9
$\theta_{2_{pyr}}$	179.3	154.6	126.5	123.7	117.8	117.4	115.8	113.7	99.1
<b>Atomic Spin Densities</b>									
C2	-0.40	-0.14	-0.02	0.05	0.08	0.09	0.12	0.33	0.00
C3	0.01	0.00	0.00	0.10	0.17	0.25	0.55	0.29	0.00
O3	-0.31	-0.06	0.00	0.13	0.14	0.17	0.27	0.16	0.00
O4	-0.05	-0.01	0.00	0.26	0.39	0.28	0.00	0.01	0.46
Oa	0.98	0.54	0.30	0.12	0.00	0.00	0.02	0.01	0.00
Ob	0.99	0.72	0.68	0.29	0.05	0.05	0.01	0.07	0.60
<b>Charge Distribution</b>									
$\Sigma q_{AC}$	-0.10	0.14	0.28	0.43	0.51	0.51	0.53	0.55	0,94
$\Sigma q_B$	0.12	0.11	0.06	0.08	0.09	0.09	0.05	0.05	0,05
$\Sigma q_{O2}$	-0.01	-0.24	-0.35	-0.51	-0.60	-0.60	-0.58	-0.60	-0,99

**H transfer in morin oxygenolysis.** Selected geometrical parameters (bond in Å and angles in degrees), atomic spin densities and NPA Atomic Charges computed for each stationary point of the morin I1c intermediate formation.

	I1	TS <sub>(I1 → I1b)</sub>	I1b	TS <sub>(I1b → I1c)</sub>	I1c
<b>Geometrical Parameters</b>					
C2-Oa	1.50	1.52	1.52	1.44	1.43
O2'-H2'	0.98	0.98	0.98	1.14	1.78
Oa-Ob	1.32	1.32	1.32	1.41	1.45
O3-H2'	1.80	2.17	2.66	2.96	3.17
Ob-H2'	3.42	2.28	1.86	1.26	0.99
$\theta_{\text{rot}}$	58.1	34.2	24.8	34.2	46.6
$\theta_{1\text{pyr}}$	129.4	127.3	157.6	123.1	119.9
$\theta_{2\text{pyr}}$	29.7	31.4	10.7	33.6	35.5
<b>Atomic Spin Densities</b>					
C1'	0.00	0.02	0.03	0.26	0.37
C3'	0.00	0.00	0.00	0.05	0.21
C5'	0.00	0.01	0.01	0.28	0.46
O2'	0.00	0.01	0.02	0.20	0.35
Oa	0.28	0.31	0.32	0.16	0.01
Ob	0.71	0.66	0.62	0.23	0.00
<b>Net Atomic Charges</b>					
Oa	-0.18	-0.18	-0.17	-0.26	-0.33
Ob	-0.15	-0.18	-0.20	-0.41	-0.47
C1'	-0.22	-0.21	-0.22	-0.10	-0.06
C5'	-0.30	-0.30	-0.30	-0.21	-0.16
$\Sigma q_{\text{AC}}$	0.25	0.27	0.28	0.26	0.24
$\Sigma q_{\text{B}}$	0.08	0.09	0.09	0.41 (0.14)	0.56 (0.29)
$\Sigma q_{\text{O2}}$	-0.33	-0.36	-0.37	-0.67 (-0.40)	-0.80 (-0.53)

**H-transferred quercetin oxygenolysis.** Selected geometrical parameters (bond in Å and angles in degrees), atomic spin densities and NPA Atomic Charges computed for each stationary point of the H-transferred quercetin oxygenolysis.

	RI <sub>H</sub>	TS1 <sub>H</sub>	I1 <sub>H</sub>	nTS2 <sub>H</sub>	I2 <sub>H</sub>
<b>Geometrical Parameters</b>					
C2-Oa	3.19	1.91	1.51	1.43	1.41
C2-C3	1.45	1.50	1.56	1.55	1.55
C3-C4	1.48	1.50	1.49	1.51	1.53
C3-O3	1.25	1.22	1.21	1.20	1.20
C4-O4	1.31	1.31	1.31	1.30	1.36
C4-Ob	-	-	3.25	1.95	1.46
Oa-Ob	1.22	1.26	1.32	1.42	1.51
θ <sub>rot</sub>	2.2	15.9	57.8	47.6	38.9
θ1 <sub>pyr</sub>	179.6	151.9	129.8	120.9	120.0
θ2 <sub>pyr</sub>	0.3	17.0	29.3	35.3	36.5
<b>Atomic Spin Densities</b>					
Oa	0.98	0.51	0.29	0.09	-
Ob	0.99	0.71	0.70	0.42	0.01
Carbon	C2 : -0.33	C2 : -0.11	-	C8 : 0.21 C10 : 0.34	C6 : 0.34 C8 : 0.46 C10 : 0.25
Oxygen	-0.27	-0.05	-	O5 : 0.19	O5 : 0.37
<b>Net Atomic Charges</b>					
Oa	-0.01	-0.14	-0.18	-0.28	-0.31
Ob	0.00	-0.11	-0.15	-0.22	-0.31
Σq <sub>AC</sub>	-0.12	0.14	0.27	0.44	0.55
Σq <sub>B</sub>	0.13	0.11	0.06	0.06	0.06

**Quercetin oxygenolysis stabilized by a model of Glu73.** Selected geometrical parameters (bond in Å and angles in degrees), atomic spin densities and NPA Atomic Charges computed for each stationary point of the quercetin oxygenolysis stabilized by a model of Glu73.

	RI <sub>Glu</sub>	TS1 <sub>Glu</sub>	I1 <sub>Glu</sub>	TS2 <sub>Glu</sub>	I2 <sub>Glu</sub>
<b>Geometrical Parameters</b>					
C2-Oa	3.06	1.96	1.53	1.42	1.41
C2-C3	1.45	1.50	1.56	1.60	1.59
C3-C4	1.52	1.53	1.54	1.62	1.71
C3-O3	1.25	1.22	1.20	1.18	1.18
C4-O4	1.24	1.24	1.24	1.24	1.27
C4-Ob	4.54	3.61	3.02	1.87	1.48
Oa-Ob	1.22	1.27	1.32	1.44	1.47
Ob-H <sub>Glu</sub>	2.52	2.00	1.92	1.83	1.94
$\theta_{\text{rot}}$	3.3	9.2	19.9	53.2	38.6
$\theta_{1\text{pyr}}$	178.9	156.0	128.9	106.3	118.3
$\theta_{2\text{pyr}}$	0.7	14.6	30.1	43.5	35.6
<b>Atomic Spin Densities</b>					
C10	0.01	0.01	0.00	0.14	0.14
O3	-0.29	0.04	0.00	0.17	0.16
O4	-0.04	-0.01	0.00	0.15	0.26
Oa	0.99	0.53	0.34	0.04	0.01
Ob	0.97	0.65	0.62	0.18	0.05
<b>Net Atomic Charges</b>					
$\Sigma q_{\text{AC}}$	-0.11	0.20	0.31	0.56	0.52
$\Sigma q_{\text{B}}$	0.14	0.14	0.08	0.13	0.13
$\Sigma q_{\text{O2}}$	-0.02	-0.31	-0.37	-0.66	-0.62
$\Sigma q_{\text{HCOOH}}$	-0.01	-0.02	-0.02	-0.03	-0.02