SUPPORTING INFORMATION

(A) GENERAL

Solvents were purified by standard procedures[1] and distilled before use. Methyl(trifluoromethyl)dioxirane (**1**) in ketone-free dichloromethane solution was prepared as described[2] and the peroxidic content of the solutions was determined by iodometric titration.[3] Solvents were removed under vacuum at 0 °C in all the cases.

(B) SYNTHESIS OF 2-SUBSTITUTED ADAMANTYL DERIVATIVES (2)

2-Adamantylmethanol acetate (**2a**) and 2-adamantylacetate (**2c**) were prepared by reaction of 2-adamantanemethanol and 2-adamantanol respectively with acetic ahydride in pyridine.[4] 2-Adamantane methanol was synthesized by reaction of lithium aluminium hydride with methyl 2-adamantane carboxylate,[5] prepared from 2-adamantane carboxylic acid.[6] 2-Adamantylamine acetate (**2b**) was prepared by reaction of 2-adamantylamine with acetic anhydride.[7] 2-Fluoroadamantane (**2d**) was prepared by reaction of 2-adamantanol with diethylaminosulfur trifluoride (DAST) following a reported procedure.[8] 2-Adamantyl methanesulfonate (**2e**) and 2-adamantyl *para*-toluensulfonate (**2f**) were prepared from 2-adamantanol by reaction with methanesulfonyl chloride and triethylamine in dry dichloromethane[9] and with *para*-toluensulfonyl chloride in dry piridine respectively.[10] 2-Adamantyl nitrate (**2g**) was obtained by reaction of 2-bromoadamantane with silver nitrate in anhydrous diethyl ether.[11] All the products were purified by column chromatography and were fully characterized by spectroscopic techniques.

2-Adamantylammonium *para*-chlorobencenesulfonate (**2h**) was synthesized by reaction of 2-adamantyl amine with *para*-chlorobencenesulfonic acid in diethyl ether and was purified by recrystallization from dichloromethane/ hexane.[12]

2-Adamantylmethylacetate (2a). ^{13}C NMR ($DCCl_3$): δ (ppm) 20.89, 27.72, 28.05, 29.19, 31.69, 37.96, 38.56, 43.07, 66.46, 171.17. HRMS (CI^+) Exact mass: 207.1385. Found: 207.1380.

2-Adamantylacetamide (2b). ^{13}C NMR ($DCCl_3$): δ (ppm) 23.69, 27.05, 27.16, 31.84, 37.07, 37.48, 53.27, 169.18. HRMS (EI^+) Exact mass: 193.1467. Found: 193.1463.

2-Adamantylacetate (2c). ^{13}C NMR ($DCCl_3$): δ (ppm) 21.42, 27.05, 27.28, 31.75, 31.85, 36.35, 37.42, 76.78, 170.48. HRMS (EI^+) Exact mass: 194.1307. Found: 194.1309.

2-Fluoroadamantane (2d). ^{13}C NMR ($DCCl_3$): δ (ppm) 29.52, 29.69, 30.04, 34.24, 34.43, 42.49, 42.57, 45.09, 67.45, 93.27, 95.05. HRMS (EI^+) Exact mass: 154.1158. Found: 154.154.1154.

2-Adamantyl methanesulfonate (2e). ^{13}C NMR ($DCCl_3$): δ (ppm) 26.52, 26.84, 31.15, 33.02, 36.36, 37.05, 38.79, 86.03. HRMS (EI^+) Exact mass: 230.0977. Found: 230.0973.

2-Adamantyl *para*toluensulfonate (2f). ^{13}C NMR ($DCCl_3$): δ (ppm) 21.61, 26.53, 26.77, 31.09, 32.64, 36.37, 37.07, 86.31, 127.47, 129.67, 134.93, 144.20. HRMS (EI^+) Exact mass: 306.1290. Found: 306.1287.

2-Adamantyl nitrate (2g). ^{13}C NMR ($DCCl_3$): δ (ppm) 26.71, 30.69, 31.49, 36.27, 36.83, 86.43. HRMS (EI^+) Exact mass: 197.1052. Found: 197.1060.

(C) SYNTHESIS AND CHARACTERIZATION OF THE *Z* AND *E* ISOMERS OF 5-HYDROXY-2-ADAMANTYL DERIVATIVES (3)

The study of the *Z/E*-selectivity in the hydroxylation of 2-substituted adamantyl derivatives **2** by glc chromatography requires the unequivocal determination of the retention times for both *Z* and *E* isomers of the 5-hydroxylated products **3**. Compounds **3** were prepared and the *Z* and *E* isomers characterized separately as reported below. Hydroxylated products derived from ammoniun salt **2h** were isolated as the free amine derivatives **3i**.

Hydroxylation of 2-adamantyl derivatives (2) with TFDO (1). Synthesis of *(Z)* and *(E)* 5-hydroxyl derivatives (3). General Procedure. To a solution of 0.14 g (0.88 mmol) of **2d** in 4.8 mL of dichloromethane cooled to -15 °C, 5.8 mL of a 0.15 M dichloromethane solution of TFDO (**1**) were added at once. The reaction was allowed to stand at -15 °C with stirring in the dark. After 2 h the solvent was removed and the residue was subjected to column chromatography, silica gel (hexane/ethylacetate 2:1). *(Z)*-2-Fluoro-5-hydroxyadamantane ((*Z*)-**3d**) eluted first and its isomer ((*E*)-**3d**) last. Both isomers were characterized as reported below (see Tables 1 and 2).

The oxidation of 2-adamantylammonium *para*-chlorobencene-sulfonate (**2h**) was carried out by adding the aliquot of dichloromethane TFDO solution to the ammonium salt dissolved in 2,2,2-trifluoroethanol. After 2 h, the reaction was treated with 5 equivalents of anhydrous potassium carbonate and allowed to stand 48 h at room temperature with stirring. The solids were filtered off, the solvent removed under vacuum and the residue subjected to column chromatography, (silica gel) eluted with a mixture of

ethylacetate/methanol, initially 98:2 and progressively enriched in methanol. A *ca.* 10:90 *Z:E* mixture of both isomers **3i** eluted first and *(Z)*-5-hydroxy-2-aminoadamantane ((*Z*)-**3i**) eluted last.

In the cases of 2-adamantylmethanol acetate (**2a**) and 2-adamantyl nitrate (**2g**), only the *(Z)*-**3a** y *(Z)*-**3g** isomers could be isolated pure by column cromatography, recovering the *E* isomers mixed (*ca.* 80:20) with the *Z* isomer.

The isomers *(Z)* and *(E)*-**3b** could not be separated completely by column chromatography and were characterized in a 75:25 *(Z)*-isomer enriched mixture.

(Z)-5-Hydroxy-2-adamantylacetate (*(Z)*-**3c**) and *(E)*-5-hydroxy-2-adamantyl-acetate (*(E)*-**3c**) could not be separated by column chromatography.

Characterization of the *Z* and *E* isomers of 5-hydroxy-2-adamantyl derivatives (3). Characterization of the *Z* and *E* isomers of the 5-hydroxylated products (**3**) was performed by ^{13}C-NMR spectroscopy. The extensive available data[13] on the ^{13}C-NMR spectra of substituted 2,5-adamantane derivatives show a characteristic patterns for each isomer which allows a straightforward identification. Tables 1 and 2 collect ^{13}C-NMR data for compounds *(Z)*-**3** and *(E)*-**3** and Charts 1 and 2 show the characteristic pattern for each isomer. Once the (*Z*) and (*E*) isomers were fully characterized, retention times in glc were assigned unequivocally. The structure of representative compounds of each series was authenticated by X-ray diffraction analyses.

In the case of compound **3c** the geometric isomers could not be separated by column chromatography or glc. The glc analysis was then performed on the trifluoroacetylated derivatives **4c** (see procedure below). The *Z/E* isomer ratio was determined by the ^{13}C NMR spectrum of the mixture and the retention times were then unequivocally established by comparison with the glc chromatogram integration.

The *Z/E* isomer ratio for compounds **3e** and **3f** was performed on the trifluoroacetylated derivatives **4e** and **4f** respectively. The unequivocal retention times for **4e** and **4f** was ascertained by comparison with authentical samples prepared from the isolated *Z* and *E* isomers of **3e** and **3f**.

(*Z*) and (*E*)-**3i** could not be separated by glc and were analyzed as trifluoroacetyl derivatives **4i**.

(E) DETERMINATION OF THE *Z/E* SELECTIVITY IN THE OXIDATION OF 2-ADAMANTANE DERIVATIVES 2 BY METHYL(TRIFLUOROMETHYL)-DIOXIRANE (TFDO) (1)

General procedure. To a 0.05 M solution of **2** in dichloromethane, cooled at -15 °C, an aliquot of a TFDO (**1**) in dichloromethane (initial **2**:**1** molar ratio 3:2) was added at once. The reaction was stirred in

the dark at -15 °C for 2 h. The mixture was evaporated under vacuum in order to remove the unreacted dioxirane and the residue was dissolved in the same volume of dichloromethane. The solution was analyzed by glc and the products identified by comparison with the authentic samples. Reactions were performed at least three times independently and each sample was analyzed by glc (the analysis was repeated at least three times) by using a BPX5 capillary column (30 m, 0.22μm i.d., 0.25 μm film thickness). The *Z/E* selectivity reported is the average of at least three independent runs. In the case of compounds **2c**, **2e**, **2f** and **2h** the crude reaction mixtures were quantitatively trifluoroacetylated by the procedures reported below.

Quantitative trifluoroacetylation of 3c. When the reaction of **2c** with TFDO (**1**) was complete as described above, the solvent was removed under vacuum and the residue dissolved in dichloromethane (2 mL). The solution was cooled to 0 °C and then it was added dropwise to a cooled solution of trifluoroacetic anhydride (5 equiv) in dichloromethane (1.5 mL). The reaction mixture was allowed to stand at 0 °C for 18 h in a flask provided of a calcium chloride tube to avoid moisture. The mixture was treated with anhydrous potassium carbonate (5 equiv respect to trifluoroacetic anhydride) for 3 h. The mixture was diluted with dichloromethane and the solids filtered off. The efficiency of the trifluoroacetylation was previously controlled by glc by using methyl *para*-chlorobenzoate as internal standard.

The same procedure was applied for **3e** and **3f**.

Quantitative trifluoroacetylation of 3i. When the reaction of **2h** with TFDO (**1**) was complete (see procedure above), the solvents were removed under vacuum and the residue was dissolved in acetonitrile (substrate concentration *ca.* 0.05 M). To this solution 5 equiv of anhydrous potassium carbonate were added and the mixture allowed to stand at room temperature for 48 h. The mixture was cooled to 0 °C and then it was dropwise added to a pre-cooled solution of trifluoroacetic anhydride (10 equiv) in dichloromethane (2 mL). The mixture was stirred at 0 °C for 48 h and then treated with solid anhydrous potassium carbonate (5 equiv) for 3 h. Solvents were removed under vacuum and the residue dissolved in dichloromethane (10 mL). The solids were filtered off and the solution analyzed by glc. The efficiency of this trifluoroacetylation procedure was previously controlled by glc with methyl *para*-chlorobenzoate as internal standard.

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