ELECTRONIC SUPPLEMENTARY INFORMATION

ELECTROCHEMICAL SYNTHESIS AND *IN-VITRO* CYTOTOXICITY STUDY OF COPPER(II) CARBOXYLATE WITH DIFFERENT FATTY ACIDS ALKYL CHAIN LENGTH

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Table S1. IC_{50} values obtained from previous studies for the treatment of Cu(II) complexes with different active ligands on A549 and HeLa cells.

Reference	IC_{50} value (μM)	
	A549	HeLa
1	188.0	-
2	85.0	-
3	42.8-208.0	25.5-65.1
4	0.4-0.9	1.7-1.9
5	10.0-12.5	1.7-2.5
6	-	15.0
7	-	2.8

Table S2 Percentage of yield and energy consumption for the optimization of electrolysis conditions during the synthesis of $CuLa_2$ and $CuSt_2$.

Compound	Parameter	Variable	Percentage yield (%)	Energy consumption (WhL^{-1})
$CuLa_2$		NaCl	6.50 ± 0.28	3.30 ± 0.03
		KNO_3	15.23 ± 0.57	4.20 ± 0.08

	Type of supporting electrolytes	NH_4Cl	19.61 ± 0.50	4.34 ± 0.04
		CH_3COONH_4	28.52 ± 0.29	4.82 ± 0.09
	Electrolysis time (h)	1	28.52 ± 0.29	4.82 ± 0.09
		2	44.13 ± 0.37	12.60 ± 0.16
		3	78.04 ± 0.28	16.66 ± 0.06
		4	99.69 ± 0.31	20.07 ± 0.07
		5	100.00 ± 0.40	24.69 ± 0.09
	Applied voltage (V)	1	14.44 ± 0.43	0.18 ± 0.04
		5	43.90 ± 0.46	5.06 ± 0.05
		10	99.69 ± 0.31	20.07 ± 0.07
		15	100.00 ± 0.17	47.70 ± 0.11
		20	100.00 ± 0.34	84.29 ± 0.13
	CH_3COONH_4 concentration (mol L^{-1})	0.01	12.32 ± 0.60	3.33 ± 0.42
		0.1	99.69 ± 0.31	20.07 ± 0.07
		0.5	98.71 ± 1.33	71.21 ± 0.14
		1.0	100.00 ± 0.69	130.70 ± 0.57
		2.0	100.00 ± 1.06	168.51 ± 0.52
$CuSt_2$	Type of supporting electrolytes	NaCl	7.17± 0.12	3.31 ± 0.04
		KNO_3	16.82 ± 0.25	4.31 ± 0.05
		NH_4Cl	19.52 ± 0.29	4.52 ± 0.08
		CH_3COONH_4	29.21 ± 0.23	5.02 ± 0.06
	Electrolysis time (h)	1	29.21 ± 0.23	5.02 ± 0.06
		2	45.14 ± 0.31	10.61 ± 0.09
		3	79.57 ± 0.66	15.27 ± 0.03
		4	99.21 ± 0.33	21.01 ± 0.04
		5	99.80 ± 0.20	25.18 ± 0.07

Applied voltage (V)	1	15.60 ± 0.12	0.22 ± 0.03
	5	41.94 ± 0.11	5.51 ± 0.12
	10	99.21 ± 0.33	21.01 ± 0.04
	15	100.00 ± 0.60	45.24 ± 0.20
	20	100.00 ± 0.71	80.60 ± 0.12
CH_3COONH_4 concentration (mol L^{-1})	0.01	15.55 ± 0.26	3.50 ± 0.03
	0.1	99.21 ± 0.33	21.01 ± 0.04
	0.5	99.80 ± 0.26	69.19 ± 0.06
	1.0	100.00 ± 0.13	133.62 ± 0.06
	2.0	100.00 ± 1.39	170.02 ± 0.17

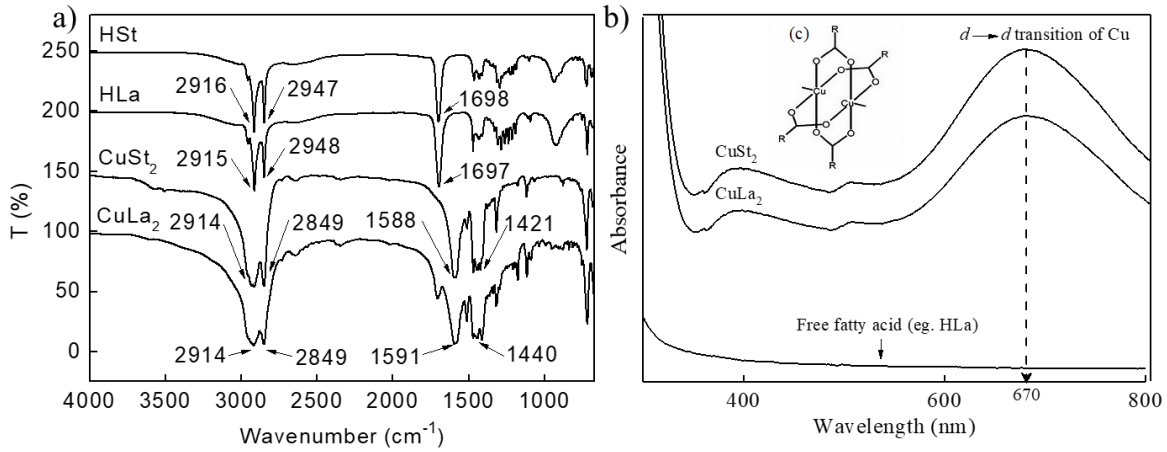

Fig. S1 (a) FTIR spectra for $CuLa_2$, $CuSt_2$, HLa dan HSt; (b) UV-Vis spectra $CuLa_2$ and $CuSt_2$ and free HLa in DMSO solvent at room temperature. (c) paddlewheel dimer structure of Cu(II) carboxylate (R = carbon chain of fatty acid).

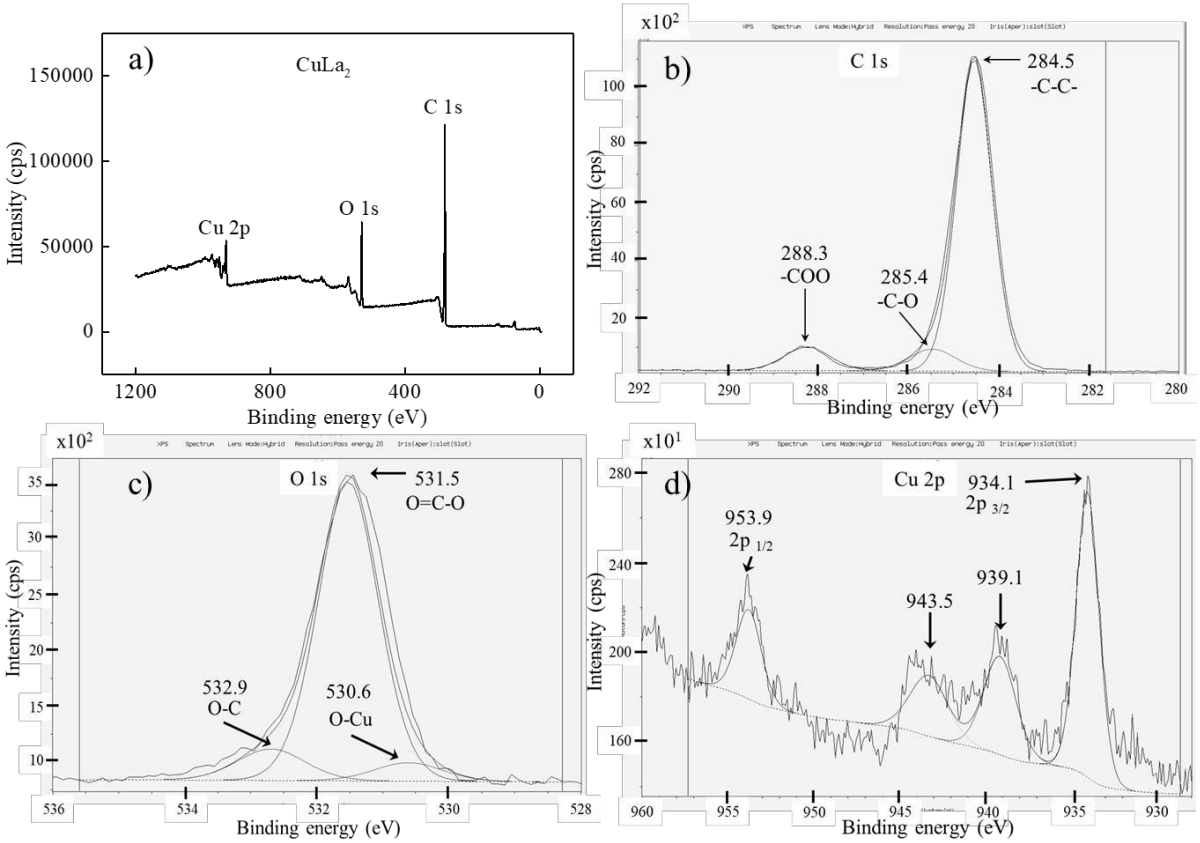

Fig. S2 (a) Wide scan; (b) C 1s; (c) O 1s; (d) Cu 2p narrow scan of $CuLa_2$ XPS spectra.

Table S3. Binding energy for C 1s, O 1s and Cu 2p narrow scan of $CuLa_2$ and $CuSt_2$ XPS spectra.

Compound	Binding energy (eV)								
	C 1s			O 1s			Cu 2p		
	COO	-C-O	-C-C-	O-C	O=C-O	O-C u	Cu 2p 3/2	Cu 2p 1/2	Satellite signal
$CuLa_2$	288.3	285.4	284.5	532.9	531.5	530.6	934.1	953.9	939.1 and 943.5
$CuSt_2$	288.1	285.5	284.5	532.7	531.5	530.0	934.0	953.8	939.0 and 943.3

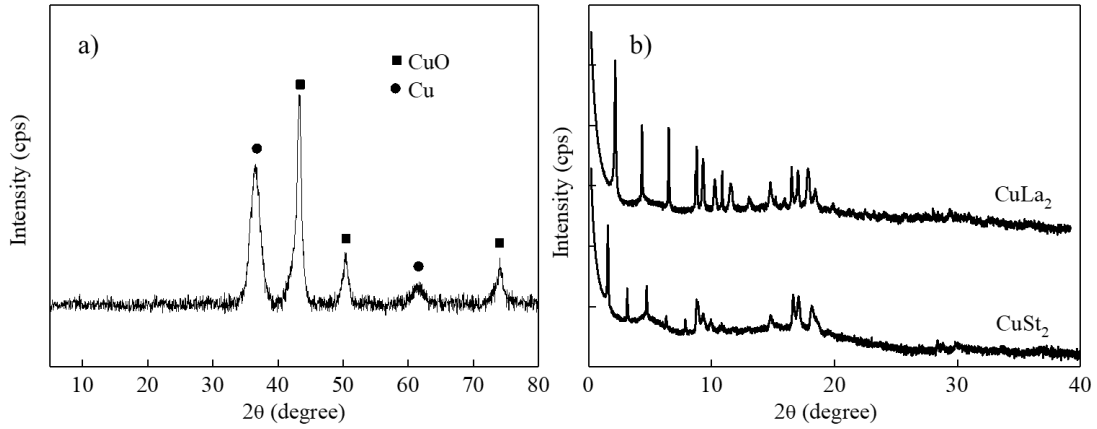

Fig. S3 XRD diffractogram of (a) CuO and Cu byproducts; (b) $CuLa_2$ and $CuSt_2$.

REFERENCES

1. J. Nagaj, P. Kolkowska, A. Bykowska, U. K. Komarnicka, A. Kyziol and M. Jezowska-Bojczuk, *Med. Chem. Res.* **24**, 115 (2015).

2. Z. Boulsourani, G. D. Geromichalos, K. Repana, E. Yiannaki, V. Psycharis, C. P. Raptopoulou, D. Hadjipavlou-Litina, E. Pontiki and C. Dendrinou-Samara, *J. Inorg. Biochem.* **105**, 839 (2011).

3. F. Bacher, O. Domotor, A. Chugunova, N. V. Nagy, L. Filipovic, S. Radulovic, E. A. Enyedy and V. B. Arion, *Dalton Trans.* **44**, 9071 (2015).

4. J. Lu, Q. Sun, J. L. Li, L. Jiang, W. Gu, X. Liu, J. L. Tian and S. P. Yan, *J. Inorg. Biochem.* **137**, 46 (2014).

5. C. H. Ng, S. M. Kong, Y. L. Tiong, M. J. Maah, N. Sukram, M. Ahmad and A. S. B Khoo, *Metallomics* **6**, 892 (2014).

6. A. N. Kate, A. A. Kumbhar, A. A. Khan, P. V. Joshi and V. G. Puranik, *Bioconjugate Chem.* **25**, 102 (2014).

7. X. Y. Qin, L. C. Yang, F. L. Le, Q. Q. Yu, D. D. Sun, Y. N. Liu and J. Liu, Dalton Trans. 42, 14681 (2013).