

Supporting information

Critical view on the qualification of electronic tongues regard-ing their performance in the development of peroral drug for-mulations with bitter ingredients

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Table S1: Summarized information about References found in between 2014-2023; CPA = change in membrane potential due to adsorption, PCA = principal component analysis, PLS = partial least squares regression, DFA = discriminant function analysis, BATA = brief aversion taste assessment – performed with rodents, NCE = new chemical entity; HME = hot melt extrudates; ODT = orodispersible tablets; ODF = orodispersible films

Year	Applied electronic tongue	Taste-masking evaluation by				Analysed drugs	Formulation	References
		Dedicated sensors	CPA value	(Statistical) analysis of electronic tongue data	Human data	Others		
2014	αASTREE II			PCA			Acetaminophen Ibuprofen Tramadol HCl Sildenafil citrate	[58]
	αASTREE II			PCA	x		Ebastine	[132]
	Insent TS-5000Z	SB2BT0		PCA and PLS	x		Propranolol HCl	[98]
	αASTREE II							
	Insent TS-5000Z			PCA			Loperamide HCl Dextromethorphan HBr	[133]
	αASTREE II			PCA and DFA	x		Sildenafil citrate	[57]
2015	Insent TS-5000Z			PCA			Diclofenac Diclofenac sodium Diclofenac potassium	[55]
	αASTREE			PCA and PLS	x		Famotidine Amlodipine besylate	[89]
	Insent TS-5000Z			PCA	x		Cetirizine HCl	[93]
2016	ASTREE			PCA			Ketoprofen	[96]
2017	Laboratory prototype potentiometric e-tongue			PCA	x		Cetirizine 2HCl	[80]
	Laboratory prototype potentiometric e-tongue			PCA	x		Cetirizine 2HCl	[90]
	αASTREE			PCA, model based on e-Tongue Euclidean distance measurements, Ka and Kd of the drug/cyclodextrin- complexes			44 bitter drugs	[71]
	Insent TS-5000Z			PCA	x		Two NCEs	[5]
	ASTREE			Bitterness score (calculated with electronic tongue software)			Mefloquine HCl	[73]
	Laboratory prototype potentiometric e-tongue			PCA	x		Cetirizine 2HCl	[81]

Year	Applied electronic tongue	Taste-masking evaluation by				Analysed drugs	Formulation	References
		Dedicated sensors	CPA value	(Statistical) analysis of electronic tongue data	Human data	Others		
2018	Insent TS-5000Z			PCA			Ranitidine HCl	Solution [134]
	ASTREE II			PCA	x		Traditional chinese herbs	Solution [135]
	ASTREE II			PCA	x	BATA	Berberine HCl	Minitablets [100]
	Insent TS-5000Z	SB2AC0 SB2AN0 SB2C00 SB2AE1		PCA		BATA	Isoniazide	HME [97]
	Laboratory prototype electrochemical impedance spectroscopy-based e-tongue			multidimensional projection techniques such as Sammon's Mapping (SAMMON) and PCA but with Interactive Document Map showing the best results			Praziquantel	Microcapsules [136]
	Insent SA402B	SB2BT0		PCA			Quinine HCl x 2 H ₂ O	HME [137]
2019	Insent TS-5000Z	SB2C00 SB2AE1 SB2AC0 SB2AN0		Sensor signal			Chlorpheniramine maleate	Solution [138]
	ASTREE II			PCA			Rhei radix et rhizome Berberine HCl Scutellaria baicalensis	Powder [139]
	αASTREE			PCA	x		Nizatidine	Powder [84]
	Laboratory prototype voltammogram-based e-tongue			PCA	x		Efavirenz	SNEDDS [105]
	Laboratory prototype potentiometric e-tongue			PCA	x		Rupatadine fumarate	Powder [83]
2020	Insent TS-5000Z	SB2BT0 SB2AN0 SB2C00 SB2AE1	x	Sensor signal		for veterinary applications	Amlodipine besylate	Minitablets [99]
	Insent TS-5000Z	SB2BT0 SB2AN0 SB2C00 SB2AE1	x	PCA			Cefpodoxime proxetil	Solution [140]
	Insent TS-5000Z	SB2AC0 SB2AN0 SB2C00 SB2AE1		Sensor signal	x	BATA	Isoniazid Rifampicin Pyrazinamide Ethambutol 2HCl	Solution [106]
	Insent SA402B	SB2BT0 (SB2AN0 SB2C00 SB2AE1)	x	PCA	x		Atomoxetine HCl	Solution [70]
	Insent SA402B	SB2AC0 SB2AN0	x	<i>bitterness intensity</i> estimated as: <i>bitterness intensity</i> 1 = 1.26 × CPA (AC0), <i>bitterness intensity</i> 2 = 1.80 × CPA (AN0) <i>bitterness scores</i> calculated on <i>bitterness intensities</i> <i>total bitterness</i> = (<i>bitterness score</i> 1 + <i>bitterness score</i> 2)/2			Propranolol HCl	Microbeads [141]

	Laboratory prototype potentiometric e-tongue		PCA	x		Rupatadine fumarate	ODT	[88]
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		Dedicated sensors	CPA value	(Statistical) analysis of electronic tongue data	Human data				Others
2021	Insent TS-5000Z	SB2BT0	X	PCA			Chlorpheniramine maleate	Nanofibres	[103]
	Insent TS-5000Z	SB2AE1 SB2CT0 SB2AC0 SB2AN0 SB2C00		PCA			Indomethacin Furosemide	ODF	[101]
	Laboratory prototype potentiometric e-tongue			PCA			Ketoprofen lysine	Solution	[142]
	Laboratory prototype electrochemical impedance spectroscopy-based e-tongue			Interactive Document Map (IDMAP)		BATA	Artesunate-Mefloquine Praziquantel, Benznidazole	Tablets	[16]
	αASTREE			Bitterness level (response value R)	x	BATA	Ibuprofen	Emulsion	[56]
	Insent TS-5000Z	SB2C00		Bitterness intensity (single sensor response)			Caffeine	Powder	[143]
	ASTREE			PCA, PLS	x		Levetiracetam	ODT	[91]
	Laboratory prototype taste biosensor (rat cardiomyocytes + microelectrode assay)			Multiple feature extraction and parameter visualization for high-content analysis			Denatonium benzoate Quinine Dephenidol Arbutin	Solution	[144]
2022	ASTREE II			PCA			Levocetirizine 2HCl	Nanofibres	[104]
	Laboratory prototype potentiometric e-tongue			Supervised LDA			Ranitidine HCl	Solution	[74]
	Laboratory prototype potentiometric e-tongue			PCA	x		Rupatadine fumarate	ODFs	[145]
	cTongue; Shanghai Baosheng, Shanghai, China			PCA			Berberine Phillyrin	Solution	[146]
	Insent SA402B	SB2AE1 SB2CT0 SB2AAE SB2CA0 SB2C00 SB2GL1		Peptides were dissolved in water and added to an 1 mM quinine HCl solution – bitterness intensity reduction activity was calculated based on the Δ sensor responses against quinine HCl as blank control and a particular peptide (LEGSLE) as positive control			Nebulin-derived peptides	Solution	[147]
	Insent TS-5000Z	SB2BT0 SB2AN0 SB2C00 SB2AE1	x	Sensor signal	x		Oseltamivir phosphate	HME	[87]
2023	Laboratory prototype potentiometric e-tongue			PCA			Rosuvastatin calcium	Granules (pellets)	[86]
	ASTREE			Relative distances	x		Azithromycin	Granules (pellets)	[85]
	Insent TS-5000Z	SB2C00 SB2AE1 SB2AN0	x	Sensor signal			Carbamazepine	ODT	[92]

	Insent SA402B	umami, saltiness, sourness, bitterness x	Random Forest, backpropagation neural network, K-nearest neighbour, support vector machine		uf-GC e-nose	Bear pile powder	Powder	[148]
	Insent TS-5000Z	SB2C00 x SB2AN0 SB2BT0 SB2AE1	Bitter value	x		Berberine HCl	Solution	[75]
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2023	Insent SA402B	SB2AN0 x		Sensor signal	x	Ibuprofen Flurbiprofen Naproxen	Solution	[149]
	Insent SA402B	SB2CA0 x SB2C00 SB2AE1 SB2AAE SB2CT0		PCA		Lisdexamfetamine	Tablets	[150]
	Insent SA402B	SB2BT0 X		Sensor signal		Diphenhydramine HCl	Granules	[82]
	Insent SA402B	SB2AC0 SB2AN0 SB2C00 SB2AE1		PCA and calculation of bitterness scores		Propranolol HCl	Solution	[72]

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