

SUPPLEMENTARY ELECTRONIC FILE

Valorisation of Purple Non-Sulfur Bacteria Biomass from Anaerobic Treatment of Fuel Synthesis Process Wastewater to Microbial Protein: A Means of Enhancing Food Security in Arid Climates

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Fig A1: FSPW in a glass beaker demonstrating its transparent and solids-free characteristics

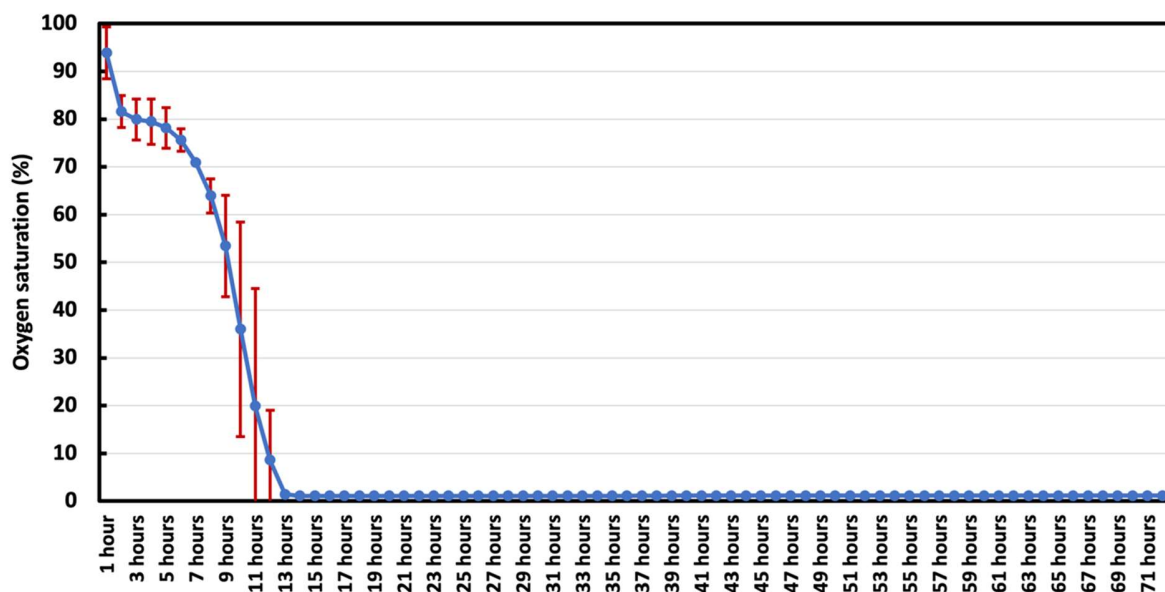


Fig A2: Trends of dissolved oxygen removal during the extensive experiment period

Table A1: FSPW constituents as reported in past literature

Plant/Location	pH/COD	Main constituents (>500 mg/L)	Other constituents (<500 mg/L)	Other constituents (<100 mg/L)	Reference
ShanXi Lu'An Coal to Liquid Co	3.0 33,000–38,000 mg/L	Ethanol, 1-propanol, isopropanol, 1-butanol, acetic acid, acetone, 2-pentanone	Methanol, 2-pentanol, propionic acid, butyric acid, valeric acid, pentane, heptane, methyl ester methanoic acid, methyl ester acetic acid	2-Methyl-1-propanol, 2-butanol, <i>tert</i> -butanol, 1-pentanol, 4-methyl-1-pentanol, 2-methyl-1-pentanol, 3-methyl-1-pentanol, hexanol, <i>n</i> -heptanol, hexane, 1-pentene, hexene, 1-heptene, acetaldehyde, propionaldehyde, butyraldehyde	(Wang, Ma, et al. 2017)
ShanXi Lu'An Coal to Liquid Co	3.0 29,000–31,000 mg/L	Ethanol, 1-propanol, isopropanol, acetate, 2-pentanone, acetone, ethyl ester acetate,	Methanol, 1-butanol, 2-butanol, 2-pentanol, methyl ester acetate, methyl ester methanoic acid, heptane, pentane, butyrate, propionate	2-Methyl-1-propanol, <i>tert</i> -butanol, 1-pentanol, 4-methyl-1-pentanol, 2-methyl-1-pentanol, 3-methyl-1-pentanol, 1-hexanol, 2-hexanol, <i>n</i> -heptanol, butyraldehyde, propionaldehyde, acetaldehyde, 1-heptene, hexene, 1-pentene, valerate	(Wang, Han, et al. 2017)
GTL plant in Qatar	3.2 2,930 mg/L	-	Acetate, propionate, isobutyrate, butyrate, valerate	Isovalerate	(Wada et al. 2023)
GTL plant in Qatar	3.6 6,767 mg/L	Acetate	Propionate, butyrate, valerate	Iso-butyrate, iso-valerate	(Shaikh et al. 2023)
-	28,000 mg/L	Alcohols (84.9%), acids (10.7%), hydrocarbons (4.5%)			(Majone et al. 2010)
Sasol, South Africa	13,000 mg/L (C ₂ -C ₅ acids)	Acetic acid (70%), propionic acid (15%), isobutyric acid (2%), n-butyric acid (8%), isovaleric acid (1%), n-valeric acid (3%) and small quantities of alcohols, ketones, and hydrocarbon			(Du Preez et al. 1985)
GTL plant in Malaysia	3.0 20,000–25,000 mg/L	1-Pentanol, butanol-1, ethanol, isopropyl-alcohol, methanol, propanol, 2-hexanone, acetone, methyl-ethyl-ketone, methyl-n-propyl-ketone, acetaldehyde, butyraldehyde, propionaldehyde, valeraldehyde, acetic acid, acetic acid, n-butyric acid, n-caproic acid, n-valeric acid, propionic acid, carbon dioxide			(Rahman et al. 2021)
GTL plant in Qatar	2.9 5,000-7,000 mg/L	Main organics: Short and long-chain alcohols, propanoic acid, butanoic acid, acetoacetic acid, esters, ketones, and aliphatics			(Surkatti et al. 2021)

Sasol	-	Water (94-98.8%), non-acid oxygenated hydrocarbons (1.1-4.8%), acidic oxygenated hydrocarbons (0.075-1.2%), other hydrocarbons (0.02%), inorganic fraction (<0.005%)	(Kohler et al. 2005)
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Table A2: Extensive organic screening of FSPW

Compound	Concentration (µg/L)
1,1,1,2-Tetrachloro-ethane	Undetected
1,1,1-Trichloro-ethane	Undetected
1,1,2-Trichloro-ethane	Undetected
1,1-Dichloro-ethane	Undetected
1,1-Dichloro-ethene	Undetected
1,1-Dichloro-propene	Undetected
1,2,3-Trichloro-propane	Undetected
1,2,4-Trichlorobenzene	Undetected
1,2,4-Trimethylbenzene	Undetected
1,2-Dibromo-3-chloropropane	Undetected
1,2-Dibromoethane	Undetected
1,2-Dichlorobenzene	Undetected
1,2-Dichloroethane	Undetected
1,2-Dichloro-propane	Undetected
1,2-Dinitrobenzene	Undetected
1,3-Dichlorobenzene	Undetected
1,3-Dinitrobenzene (1,3-DNB)	Undetected
1,4-Dichlorobenzene	Undetected
1,4-Dinitrobenzene	221.5±4.9
1,4-Dioxane	26.8±0.1
1-Methylnaphthalene	Undetected
2,2-Dichloro-propane	Undetected
2,3,4,6-Tetrachlorophenol	0.0075±0.001
2,3,5,6-Tetrachlorophenol	0.9125±0.1
2,4,5-Trichlorophenol	Undetected
2,4,6-Trichlorophenol	0.009±0.001
2,4-Dichlorophenol	Undetected
2,4-Dimethylphenol	11.85±0.5
2,4-Dinitrophenol	0.048±0.01
2,4-Dinitrotoluene	Undetected
2,6-Dinitrotoluene	3.57±0.2
2-Chlorotoluene	Undetected
2-Chloronaphthalene	0.008±0.001
2-Chlorophenol	Undetected
2-Chlorophenol-D4	Undetected
2-Fluorobiphenyl (surr)	0.014±0.003
2-Methylnaphthalene	Undetected
2-Methylphenol	4.36±0.01
2-Nitroaniline	0.029±0.001
2-Nitrophenol	0.3035±0.02
3-Methylphenol	4.285±0.01
3-Nitroaniline	Undetected

4,6-Dinitro-2-methylphenol	0.144±0.02
4-Bromophenyl phenyl ether	1.496±0.8
4-Chloro-3-methylphenol	Undetected
4-Chlorophenyl phenyl ether	Undetected
4-Methylphenol	0.0275±0.01
4-Nitroaniline	0.2095±0.04
4-Nitrophenol	Undetected
Acenaphthene*	Undetected
Acenaphthylene*	217±19.8
Acetonitrile	Undetected
Acrylonitrile	22.5±0.4
Aniline	1.08±0.01
Anthracene*	Undetected
Azobenzene	Undetected
Benz(a)anthracene*	Undetected
Benzene	Undetected
Benzene, n-butyl	Undetected
Benzene, nitroso	Undetected
Benzo(a)pyrene*	Undetected
Benzo(b)fluoranthene*	Undetected
Benzo(g,h,i)perylene*	Undetected
Benzo(k)fluoranthene*	Undetected
Benzyl alcohol	Undetected
Bis(2-chloro-1-methylethyl)ether	Undetected
Bis(2-chloroethoxy)methane	Undetected
Bis(2-chloroethyl)ether	Undetected
Bis(2-ethylhexyl)phthalate	Undetected
Bromo-benzene	Undetected
Bromochloro-methane	Undetected
Bromoform	Undetected
Butyl benzyl phthalate	0.002±0
Carbazole	0.0085±0.001
Carbon disulfide	Undetected
Carbon tetrachloride	Undetected
Chloro-benzene	Undetected
Chloroform	Undetected
Chloroprene (2-chloro-1,3-butadiene)	30.3±0.1
Chrysene*	0.008±0
Cis-1,2-dichloroethene	Undetected
Cis-1,3-dichloropropene	Undetected
Cis-1,4-dichloro-1-butene	Undetected
Dibenz(a,h)anthracene	0.0285±0.004
Dibenzofuran	Undetected
Dibromochloromethane	Undetected
Dibromo-methane	Undetected
Diethyl ether (Ethyl ether)	Undetected
Diethyl phthalate	Undetected
Dimethyl phthalate	Undetected
Di-n-butyl phthalate	0.0085±0.001

Di-n-octyl phthalate	0.003±0
Diphenylamine	0.0045±0.001
Ethyl methacrylate	Undetected
Ethylbenzene	Undetected
Fluoranthene*	1.2±00.8
Fluorene*	0.014±0
Hexachlorobenzene	11.695±3.8
Hexachlorobutadiene	Undetected
Hexachlorobutadiene	Undetected
Hexachlorocyclopentadiene	Undetected
Hexachloroethane	Undetected
Indeno(1,2,3-cd)pyrene*	Undetected
Iodomethane	Undetected
Isophorone	Undetected
Isopropyl benzene	Undetected
m+p-Xylene	Undetected
Methyl methacrylate	Undetected
Methylacrylonitrile	Undetected
Methylene chloride	4034±0
Naphthalene*	0.023±0.01
Nitrobenzene	Undetected
N-Nitrosodimethylamine	0.2±0.01
N-Nitrosodi-n-propylamine	Undetected
o-xylene	Undetected
Pentafluoro benzene	Undetected
Phenanthrene*	Undetected
Phenol	Undetected
Propionitrile	Undetected
Pyrene*	0.007±0
Pyridine	Undetected
Styrene	Undetected
Tertiary butyl benzene	Undetected
Tetrachloroethylene	Undetected
Tetrahydrofuran	Undetected
Toluene	Undetected
Trans-1,2-dichloroethene	Undetected
Trichloroethene	Undetected

*USEPA priority polyaromatic hydrocarbons

Table A3: Metal analysis of FSPW

	Concentration in FSPW(mg/L)	WEPA maximum permissible limit for drinking water (mg/L)	WEPA maximum permissible limit for industrial effluent (mg/L)
Nutritionally undesirable metals			
As	Undetected	0.01-0.05	0.25
Cd	Undetected	0.003	0.03
Hg	Undetected	0.001	0.005
Pb	Undetected	0.01	0.2
Tl	Undetected	-	-
Nutritionally desirable metals			
Co	0.2±0.0	-	-
Cr	Undetected	0.05	0.1
Cu	Undetected	2	0.5
Fe	0.65±0.07	<1	2.0
Mn	0.9±0.06	0.5	1.0
Mo	Undetected	-	-
Ni	Undetected	0.02	0.2-6.4
Se	Undetected	0.01	
Zn	0.7±0.1	5	1.0
Other metals			
Al	Undetected	0.2	-
K	8.7±0.3	-	-
Sr	Undetected	-	-
Ba	Undetected	0.7	1.0
Be	Undetected	0.5	-

Table A4: Metal concentration in each feedstock constituent

Metal	FSPW (mg/L)	Trace (mg/L)	Vitamin (mg/L)
Co	0.2±0.0	0.2±0.001	Undetected
Cu	Undetected	0.03±0.0	Undetected
K	8.7±0.3	0.001±0.0	0.3±0.0
Mn	0.9±0.06	1.6±0.001	Undetected
Mo	Undetected	0.04±0.0	Undetected
Ni	Undetected	0.05±0.0	Undetected
Sr	Undetected	0.003±0.0	Undetected
Zn	0.7±0.1	0.2±0.003	Undetected
Fe	0.65±0.07	0.2±0.001	Undetected
Cr	Undetected	Undetected	Undetected