

7 Appendix

Appendix A: Abbreviation directory

Appendix B: List of chemical compounds

Appendix C: Odorants associated with sewage treatment works (Abbott, 1993; Bonnin et al., 1990; Brennan, 1993; Cheremisinoff, 1988; Koe, 1989; Vincent and Hobson, 1998; Young, 1984; Metcalf and Eddy, 1995)

Appendix D: Detectable H₂S concentration and physiological response

Appendix E: Changes of the redox potential in the rhizosphere of the Planted Fixed Bed Reactor at the day 200 (experimental phase C).

Appendix A: Abbreviation directory

AMD	acid main drainage
Anammox	anaerobic ammonia oxidation
APS	adenosine phosphosulphate
ASTM	american society for testing and material
AVS	acid volatile sulphide
BOD ₅	5-day biochemical oxygen demand
d	day
DIN	german institute for standardization
DO	dissolved oxygen
DOC	chemical oxygen demand
Eh	redox potential
EPS	environmental protection and safety
et al.	and others, (Latin: et alteri)
Fig.	figure
FSW	free surface wetland
<i>F_o</i>	fluorescence of photosystem II
<i>F_m</i>	fluorescence following a pulse of saturation light
<i>F_v/F_m</i>	photochemical efficiency of photosystem II
HPLC	high performance liquid chromatography
HRT	hydraulic retention time
IC	ion chromatography
<i>J. effusus</i>	<i>Juncus effusus</i> sp.
PAM 2000	pulse amplitude modulated fluorometer
PFBR	planted fixed bed reactor
ppm	part per million
ppmv	parts per million by volume
ppmb	parts per billion by volume
PCA	principal component analysis
PS II	photosystem II
RGR	relative growth rate
sp.	species, (Latin: species)
SRB	sulphate reducing bacteria
SSW	subsurface wetland
Tab.	table
TC	total carbon
TKN	total Kjeldahl nitrogen

TN	total nitrogen
TOC	total organic carbon
TSS	total suspended solid
UASB	up flow anaerobic sludge blanket
UFZ	Helmholtz Centre for Environmental Research
WW	wastewater
WWT	wastewater treatment
W1	horizontal flow laboratory-scale constructed wetland one
W2	horizontal flow laboratory-scale constructed wetland two
W3	horizontal flow laboratory-scale constructed wetland three

Appendix B: List of chemical compounds

Name	Producer
Sodium acetate	Merk
Ammoniumchlorid	Merk
Sodium chloride	Merk
Magnesium chloride hexahydrate	Merk
Sodium dihydrogen phosphate dihydrate extra pure	Merk
Calcium chloride dihydrate	Merk
Sodium sulfide hydrate	Fluka

Appendix C: Odorants associated with sewage treatment works (Abbott, 1993; Bonnin et al., 1990; Brennan, 1993; Cheremisinoff, 1988; Koe, 1989; Vincent and Hobson, 1998; Young, 1984; Metcalf and Eddy, 1995).

Class	Compound	Formula	Character	
Sulphurous	Hydrogen sulphide	H ₂ S	Rotten eggs	
	Dimethyl sulphide	(CH ₃) ₂ S	Decayed vegetables, garlic	
	Diethyl sulphide	(C ₂ H ₅) ₂ S	Nauseating, ether	
	Diphenyl sulphide	(C ₆ H ₅) ₂ S	Unpleasant, burnt rubber	
	Diallyl sulphide	(CH ₂ CHCH ₂) ₂ S	Garlic	
	Carbon disulphide	CS ₂	Decayed vegetables	
	Dimethyl disulphide	(CH ₃) ₂ S ₂	Putrifaction	
	Methyl mercaptan	CH ₃ SH	Decayed cabbage, garlic	
	Ethyl mercaptan	C ₂ H ₅ SH	Decayed cabbage	
	Propyl mercaptan	C ₃ H ₇ SH	Unpleasant	
	Butyl mercaptan	C ₄ H ₉ SH	Unpleasant	
	tButyl mercaptan	(CH ₃) ₃ CSH	Unpleasant	
	Allyl mercaptan	CH ₂ CHCH ₂ SH	Garlic	
	Crotyl mercaptan	CH ₃ CHCHCH ₂ SH	Skunk., rancid	
	Benzyl mercaptan	C ₆ H ₅ CH ₂ SH	Unpleasant	
	Thiocresol	CH ₃ C ₆ H ₄ SH	Skunk., rancid	
	Thiophenol	C ₆ H ₅ SH	Putrid, nauseating, decay	
	Sulphur dioxide	SO ₂	Sharp, pungent, irritating	
	Nitrogenous	Ammonia	NH ₃	Sharp, pungent
		Methylamine	CH ₃ NH ₂	Fishy
Dimethylamine		(CH ₃) ₂ NH	Fishy	
Trimethylamine		(CH ₃) ₃ N	Fishy, ammoniacal	
Ethylamine		C ₂ H ₅ NH ₂	Ammoniacal	
Diethylamine		(C ₂ H ₅) ₂ NH ₂		
Triethylamine		(C ₂ H ₅) ₃ N		
Diamines, i.e. Cadaverine		NH ₂ (CH ₂) ₅ NH ₂	Decomposing meat	
Pyridine		C ₆ H ₅ N	Disagreeable, irritating	
Indole		C ₈ H ₆ NH	Faecal, nauseating	
Scatole or Skatole		C ₉ H ₈ NH	Faecal, nauseating	
Acid	Acetic (ethanoic)	CH ₃ COOH	Vinegar	
	Butyric (butanoic)	C ₃ H ₇ COOH	Rancid, sweaty	
	Valeric (pentanoic)	C ₄ H ₉ COOH	Sweaty	
Aldehydes and ketones	Formaldehyde	HCHO	Acrid, suffocating	
	Acetaldehyde	CH ₃ CHO	Fruit, apple	
	Butyraldehyde	C ₃ H ₇ CHO	Rancid, sweaty	
	Isobutyraldehyde	(CH ₃) ₂ CHCHO	Fruit	
	Isovaleraldehyde	(CH ₃) ₂ CHCH ₂ CHO	Fruit, apple	
	Acetone	CH ₃ COCH ₃	Fruit, sweet	
	Butanone	C ₂ H ₅ COCH ₃	Green, apple	

Appendix D: Detectable H₂S concentration and physiological response

Detectable Concentration	Physiological response
10 ppm	Beginning eye irritation
50-100 ppm	Slight conjunctivitis and respiratory after 1 hour exposure
100 ppm	Coughing, eye irritation, loss of sense of smell after 2-15 minutes. After respiration, pain in the eyes and drowsiness after 15-30 minutes followed by throat irritation after 1 hour. Several hours exposure results in gradual increase in severity of these symptoms and death may occur within the next 48 hours.
200-300 ppm	Marked conjunctivitis and respiratory tract irritation after 1 hour of exposure.
500-700 ppm	Loss of consciousness and possibly death in 30 minutes to 1 hour.
700-1000 ppm	Rapid unconsciousness, cessation of respiration and death.
1000-2000 ppm	Unconsciousness at once, with early cessation of respiration and death in a few minutes. Death may occur even if individual is removed to fresh air at once.

Appendix E: Changes of the redox potential in the rhizosphere of the Planted Fixed Bed Reactor at the day 200 (experimental phase C).

