Supplementary information

1. Characterisation of ImpAs-HypoGel and ImpAs-Purolite

1.1 Determination of the active sites of HypoGel

The zinc loading on the receptor at **ImpAs-HypoGel** was determined by UV-Vis spectroscopy using pyrocatechol violet (PV) since it undergoes a colour change in the presence of this metal ion. Tables S1 show the values of absorbance and the calculations done to determine the zinc loading and the active sites. First, the concentration of zinc that remains in the solution was calculated with the calibration curve (see Figure S1) and the volumes used in the measurement (see table S2). Then, the amount of zinc attached was quantified by subtracting the initial quantity of zinc. And finally, this number was divided by the amount of **ImpAs-HypoGel** obtained at the end of the synthesis. The active sites were calculated dividing by two the zinc loading value, as we assume that each receptor loads two zinc ions, as it has two coordination sites.

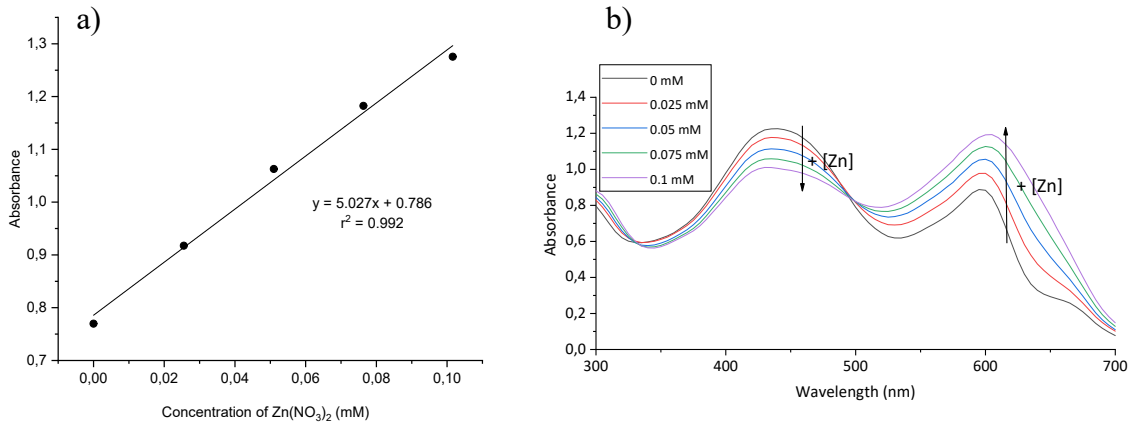

Figure S1: a) Calibration curve of $Zn(NO_3)_2$ standard measured at 605 nm for the determination of the zinc loading of **ImpAs-HypoGel** using pyrocatechol violet as zinc-sensitive dye; b) Titration of $Zn(NO_3)_2$ standards from 0 to 0.1 mM.

Table S1: UV-Vis absorbance, concentration of zinc in solution, attached and loaded onto **ImpAs-HypoGel** and active sites in triplicate (sd = standard deviation).

ImpAs-HypoGel	Absorbance (605 nm)	Concentration of zinc in solution (mM)	Zinc attached (mmol)	Loading of zinc (mmol/g)	Active sites (mmol/g)
1	1.1769	121.11	3.77	0.5372	0.2686
2	1.1810	122.40	3.66	0.5217	0.2608
3	1.1753	120.62	3.81	0.5432	0.2672
			Mean ± sd	**0.53 ± 0.01**	**0.27± 0.01**

Table S2: Parameters of synthesis and UV-Vis measurements of **ImpAs-HypoGel** used for the calculations of the zinc loading (PV = pyrocatechol violet).

Volume of sample in the cuvette (µl)	0.45
Volume of PV (µl)	700
Volume of synthesis solution (ml)	85
Initial Zn (mmol)	14.07
ImpAs-HypoGel (g)	7.02

1.2 Determination of the active sites of Purolite

The zinc loading on the receptor at **ImpAs-Purolite** was determined by UV-Vis following the procedure described in section 1.1 (see Figure S2 and Table S3)

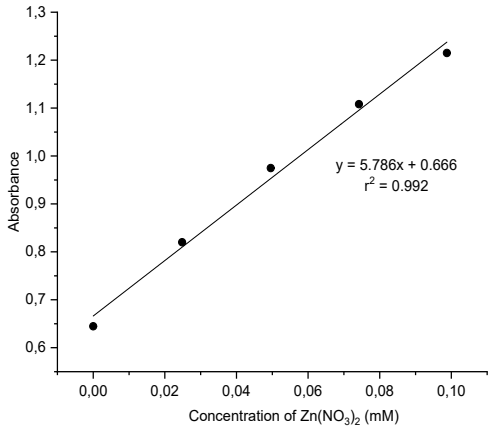

Figure S2: Calibration curve of $Zn(NO_3)_2$ standard measured at 605 nm for the determination of the zinc loading of **ImpAs-Purolite**

Table S3: UV-Vis absorbance, concentration of zinc in solution, attached and loaded onto **ImpAs-Purolite** and active sites in triplicate (sd = standard deviation).

ImpAs-Purolite	**Absorbance (605 nm)**	**Concentration of zinc in solution (mM)**	**Zinc attached (mmol)**	**Loading of zinc (mmol/g)**	**Active sites (mmol/g)**
1	0.9793	37.9319	3.7254	1.2758	0.6379
2	0.9751	37.4344	3.7797	1.2944	0.6472
3	0.9706	36.8853	3.8395	1.3149	0.6575
			Mean ± sd	**1.30 ± 0.02**	**0.65 ± 0.01**

Table S4: Parameters of synthesis and UV-Vis measurements of **ImpAs-Purolite** used for the calculations of the zinc loading.

Volume of sample in the cuvette (µl)	1
Volume of PV (µl)	700
Volume of synthesis solution (ml)	109
Initial Zn (mmol)	7.86
ImpAs-Purolite (g)	2.92

1.3 Determination of the ligand loaded onto HypoGel and Purolite

The ligand loaded onto HypoGel and Purolite (values shown in table 2) was calculated after step 1 of the synthesis, subtracting the amount of initial support from the amount of compound **2** obtained and then dividing by the amount of compound **2**.

$$Ligand\ loading = \frac{(mc2 - ms)\cdot 1000}{559.7\cdot mc2} \qquad (1)$$

where *mc2* corresponds to the mass of compound **2** (g), *ms* is the initial mass of support (g) and 559.7 g mol^{-1} is the molar mass of the ligand.

2 Characterisation of ImpAs-Merrifield

2.1 Determination of the active sites of ImpAs-Merrifield

The active sites of **ImpAs-Merrifield** were determined by UV-Vis spectroscopy. Table S5 shows the values of absorbance and the calculations done to determine the loading. First, the concentration of compound **3** that remains in the solution was calculated with the calibration curve (see Figure S3) and the volumes used in the measurement (see table S6). Then, the amount of compound **3** attached was quantified by subtracting the initial quantity of compound **3**. And finally, this number was divided by the amount of **ImpAs-Merrifield** obtained at the end of the synthesis.

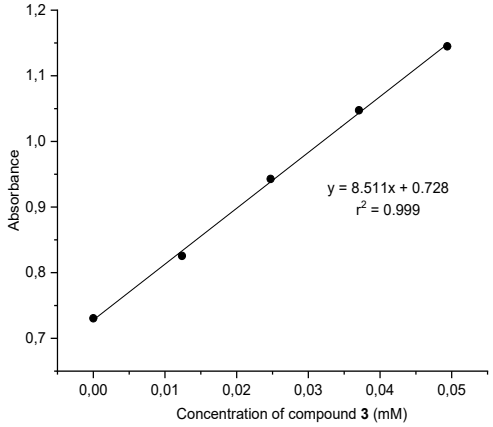

Figure S3: Calibration curve of compound **3** measured at 605 nm

Table S5: UV-Vis absorbance, concentration of compound **3** in solution and attached to **ImpAs-Merrifield** and active sites in triplicate (sd = standard deviation).

ImpAs-Merrifield	Absorbance (605 nm)	Concentration of compound 3 in solution (mM)	Compound 3 attached (mmol)	Active sites (mmol/g)
1	0.8058	6.4146	0.0478	0.4077
2	0.8843	6.4517	0.0449	0.3815
3	0.8059	6.4260	0.0470	0.4000
			Mean ± sd	**0.40 ± 0.01**

Table S6: Parameters of synthesis and UV-Vis measurements of **ImpAs-Merrifield** used for the calculations of the zinc loading.

Volume of sample in the cuvette (µl)	1
Volume of PV (µl)	700
Volume of synthesis solution (ml)	83
Initial compound **3** (mmol)	0.5804
ImpAs-Merrifield (g)	0.1176

2.2 Determination of the compound 3 loaded onto Merrifield

The ligand loaded onto Merrifield (values shown in table 2) was calculated in an analogous way to HypoGel and Purolite (see above). The amount of support Merrifield was subtracted from the total **ImpAs-Merrifield** obtained and, then divided by the amount of **ImpAs-Merrifield.**

$$Ligand\ loading = \frac{(mf - ms)\cdot 1000}{689.5\cdot mf} \qquad (2)$$

where *mf* corresponds to the final mass of **ImpAs-Merrifield** (g), *ms* is the mass of support (g) and 689.5 g mol^{-1} is the molar mass of compound **3**.

3 Scanning electron microscopy (SEM) of ground Purolite C106

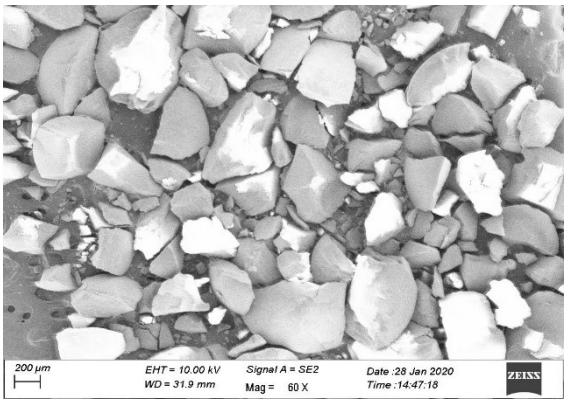

Figure S4: SEM image of the ground **ImpAs-Purolite** at a scale of 200 µm and a magnification factor of x60. The initially spherical particles were broken down into non-uniform shapes that are smaller in size as well as display higher surface area.

4 Arsenate adsorption isotherms

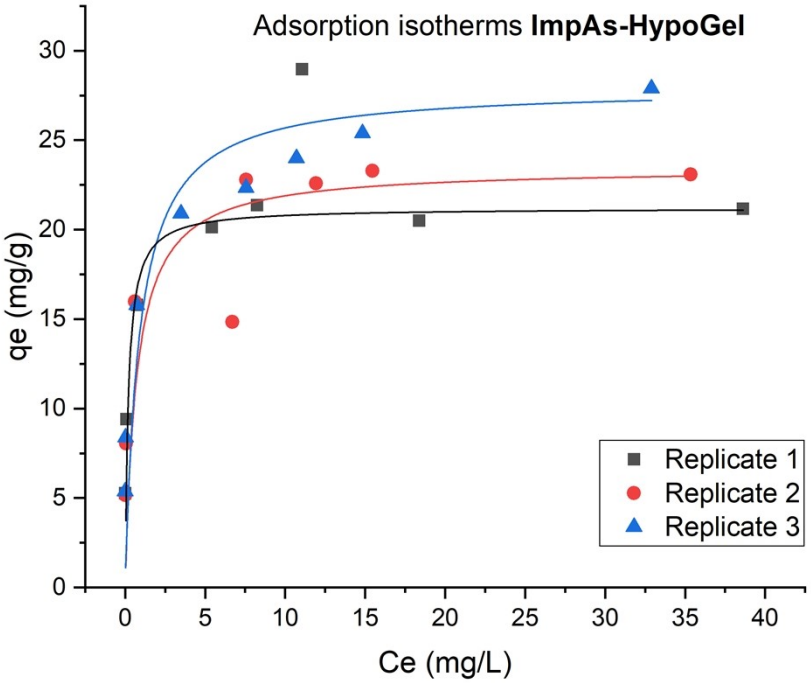

Figure S5: Adsorption isotherms of **ImpAs-HypoGel** performed with solutions from 3 mg/L to 50 mg/L of arsenate in HEPES buffer (10 mM, pH 7.4) for 24 hours at room temperature.

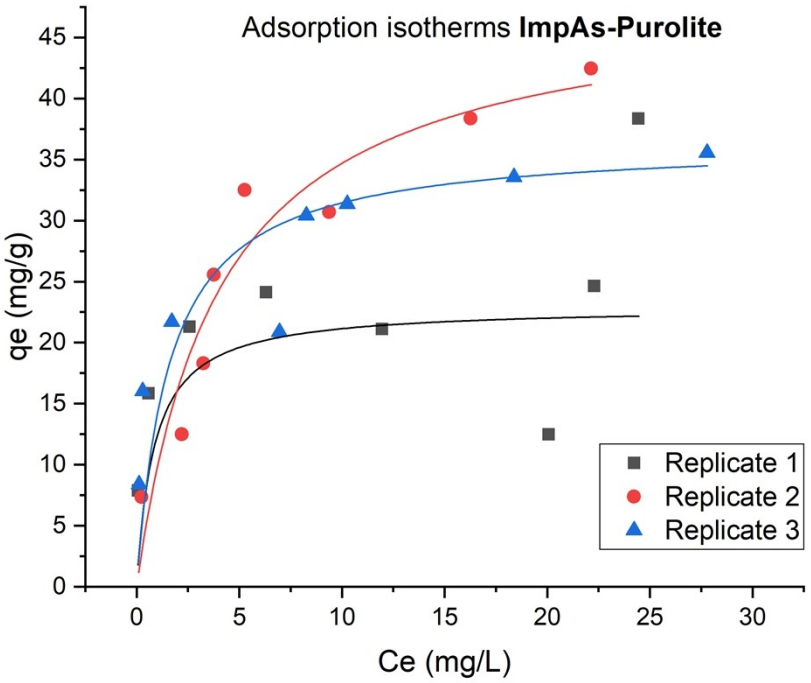

Figure S6: Adsorption isotherms of **ImpAs-Purolite** performed with solutions from 5 mg/L to 50 mg/L of arsenate in HEPES buffer (10 mM, pH 7.4) for 24 hours at room temperature.

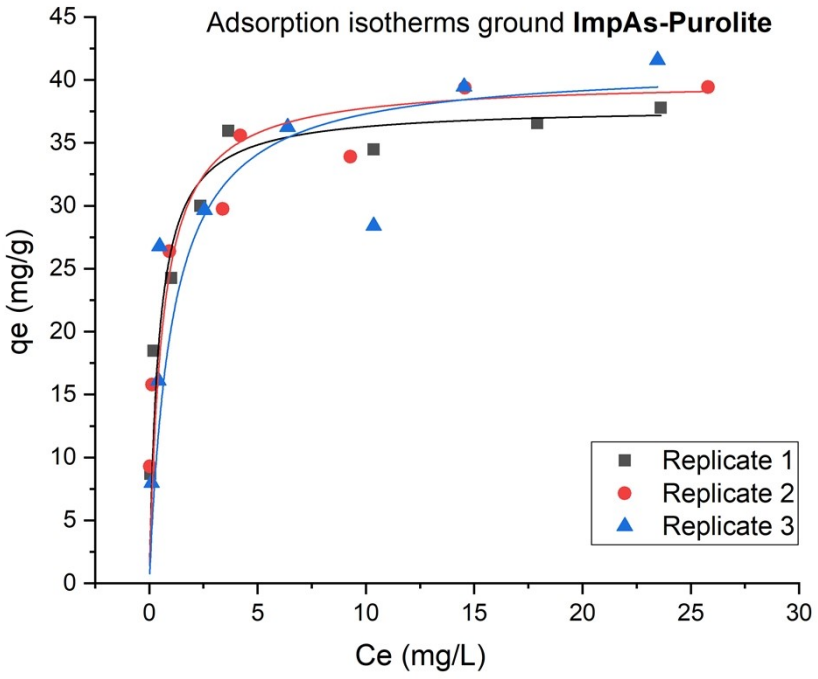

Figure S7: Adsorption isotherms of ground **ImpAs-Purolite** performed with solutions from 5 mg/L to 50 mg/L of arsenate in HEPES buffer (10 mM, pH 7.4) for 24 hours at room temperature.

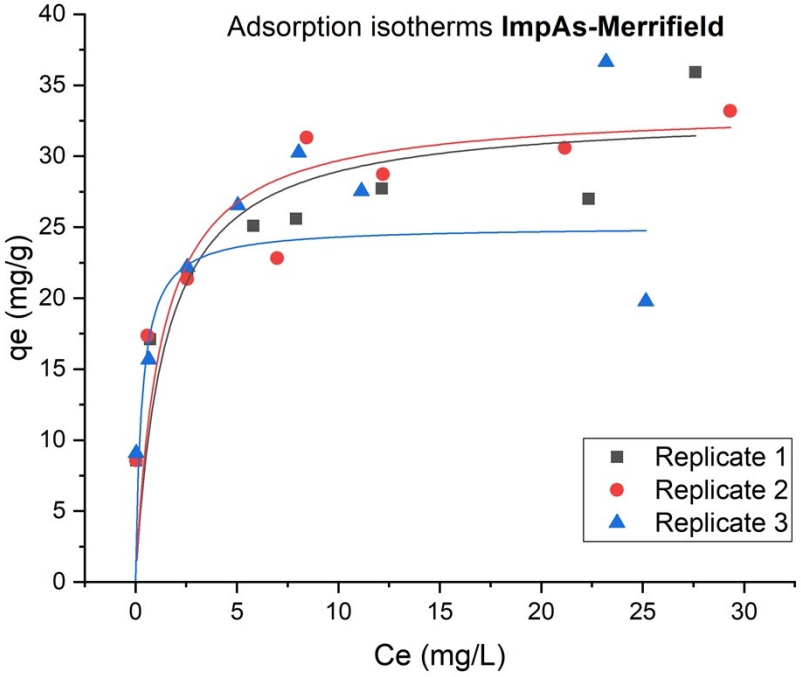

Figure S8: Adsorption isotherms of **ImpAs-Merrifield** performed with solutions from 5 mg/L to 50 mg/L of arsenate in HEPES buffer (10 mM, pH 7.4) for 24 hours at room temperature.

Table S7: Three replicates and mean of the maximum arsenate adsorption capacity of each sorbent obtained from the adsorption isotherms.

Sorbent	Q_{max} 1 (mg/g)	Q_{max} 2 (mg/g)	Q_{max} 3 (mg/g)	Mean (mg/g)
ImpAs-HypoGel	21.21	23.45	27.95	24 ± 3
ImpAs - Purolite	22.95	48.56	36.46	36 ± 13
ground **ImpAs - Purolite**	37.86	39.97	41.17	40 ± 2
ImpAs - Merrifield	33.07	33.38	25.06	31 ± 5

5 Data from flow experiments

Table S8: Percentage of arsenate removed by each sorbent and concentration of arsenate remaining after treating 50 ml of two different solutions (10 µg/L and 300 µg/L of arsenate) at two flow rates (1 ml/min and 5 ml/min). The results were obtained in triplicate.

	10 µg/L of arsenate				**300 µg/L of arsenate**			
	1 ml/min		**5 ml/min**		**1 ml/min**		**5 ml/min**	
Sorbent	**% removal**	**Conc. As(V) (µg/L)**	**% removal**	**Conc. As(V) (µg/L)**	**% removal**	**Conc. As(V) (µg/L)**	**% removal**	**Conc. As(V) (µg/L)**
ImpAs-HypoGel	100 ± 1	< 0.097*	85 ± 3	2.3 ± 0.4	100 ± 1	< 0.097*	99.4 ± 0.07	1.7 ± 0.2
ImpAs - Purolite	76 ± 4	3.6 ± 0.5	61 ± 8	6 ± 1	93 ± 1	20 ± 4	67 ± 1	100 ± 4
ground **ImpAs - Purolite**	99 ± 2	0.2 ± 0.3	76 ± 3	3.6 ± 0.4	99.5 ± 0.07	1.6 ± 0.2	97.5 ± 0.9	7.6 ± 3
ImpAs - Merrifield	99.8 ± 0.4	0.04 ± 0.06	85 ± 2	2.3 ± 0.3	99.6 ± 0.2	1.3 ± 0.5	99.4 ± 0.07	1.9 ± 0.2

*Value below the detection limit of ICP-MS

Table S9: Arsenate removal capacity (Q_{max}) of the **ImpAs** sorbents after the flow through experiment (1 g of **ImpAs** treated 300 ml of 15 µg/L solution and 300 ml of 300 µg/L solution).

		After the flow through experiment	
Sorbent	**Q_{max} (mg/g)**	**Remaining Q_{max} (mg/g)**	**% of remaining Q_{max}**
ImpAs-HypoGel	24 ± 3	23.9060	99.61
ImpAs - Purolite	36 ± 13	35.9062	99.74
ground **ImpAs - Purolite**	40 ± 2	39.9073	99.77
ImpAs - Merrifield	31 ± 5	30.9246	99.76

Table S10: Quantity of water with 20 µg/L of arsenate that can be treated by 1 gram of the different **ImpAs** sorbents, calculated from the Q_{max} values.

Sorbent	**Quantity of water with 20 µg/L of arsenate treated by 1 g of sorbent (L)**
ImpAs-HypoGel	1200
ImpAs - Purolite	1800
ground **ImpAs - Purolite**	2000
ImpAs - Merrifield	1550