Electronic Supplementary Material (ESI) for Nanoscale.

Supporting Information

Effect of Surface Chemistry on Bio-conjugation and Bio-recognition Abilities of 2D Germanene Materials

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Background line shape: Linear for Ge 2p, Shirley for C 1s.

Peak line shape: Product of a Gaussian with a Lorentzian (GL(30)) as defined in Casa XPS software.

	MATERIAL	Ge $2p_{3/2}$		C 1s	
		Ge-C/H	Ge-Ox	Adv C	C-Ge
POSITION FWHM (%)	Ge-Me	1218.7 4.1 (96.0%)	1220.9 2.0 (4.0%)	285.2 3.2 (73.6%)	283.2 3.5 (26.4)
	Ge-H	1218.5 4.1 (94.6%)	1221.2 1.5 (5.4%)	284.9 3.4 (100%)	-

Table S1: Parameters for XPS fitting used in Figure 1 corresponding to Ge-Me and Ge-H.

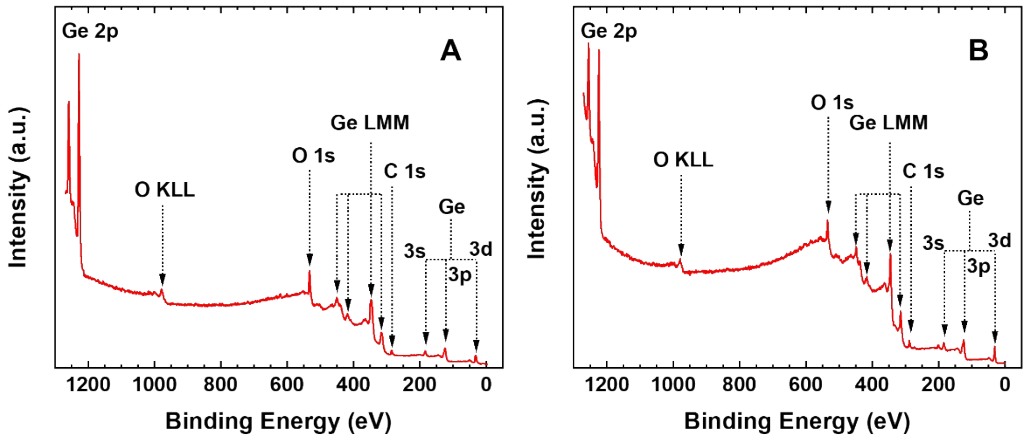

Figure S1: X-ray Photoelectron Spectroscopy (XPS) spectra for survey scans with Ge-Me (A) and Ge-H (B).

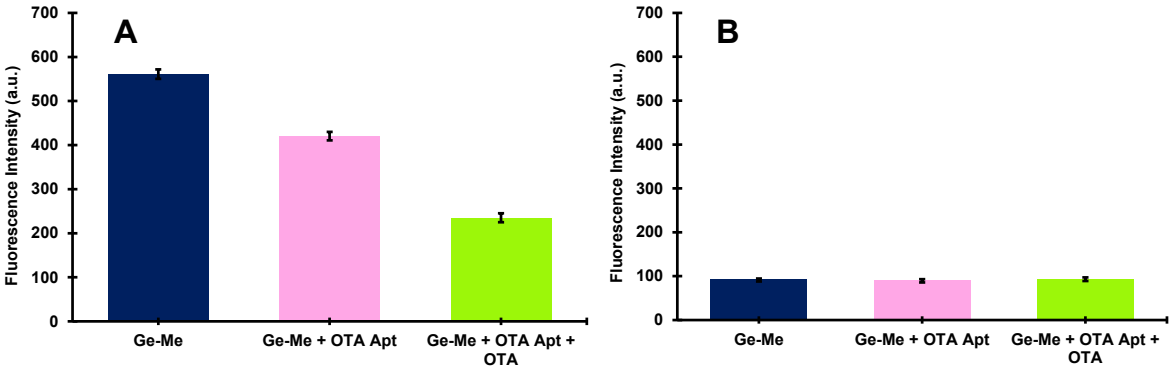

Figure S2: Histogram plot illustrating the preliminary experiment involving (A) Ge-Me and (B) Ge-H before and after conjugation with OTA aptamer and OTA. Error bars correspond to triplicate measurements performed.

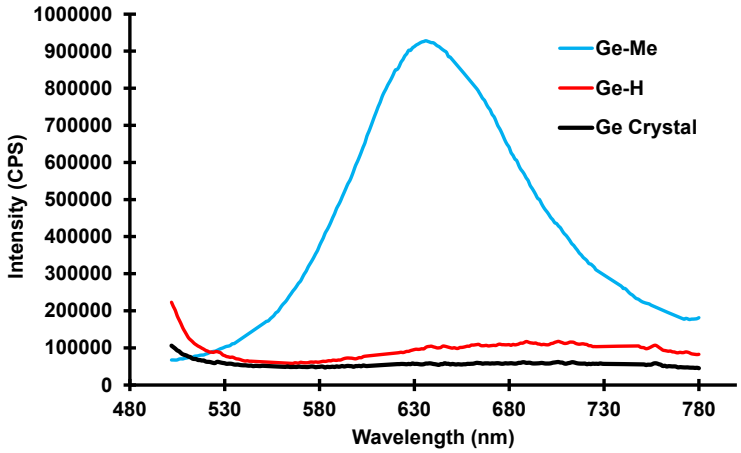

Figure S3: Photoluminescence (PL) spectra of Ge crystal, Ge-H and Ge-Me.

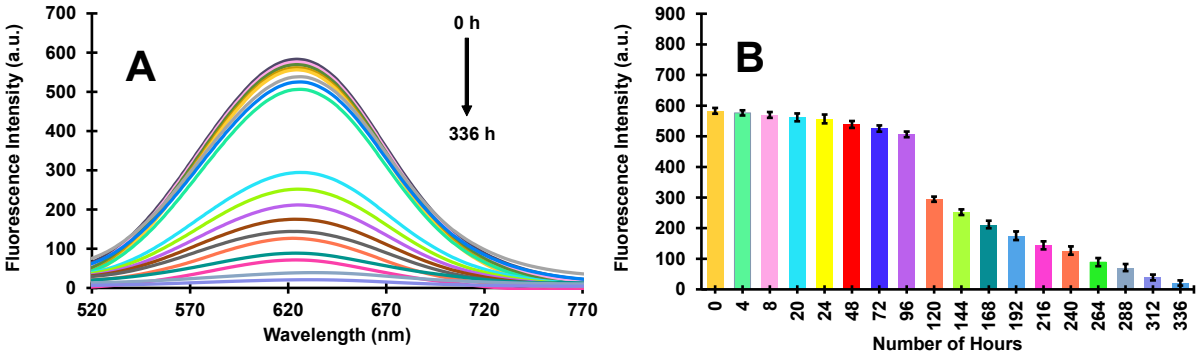

Figure S4: (A) Lifetime study performed with 1 mg/mL of Ge-Me (ranging from 0 mins to 336 hours). (B) Corresponding histogram plots displaying the change in fluorescence intensity over time.

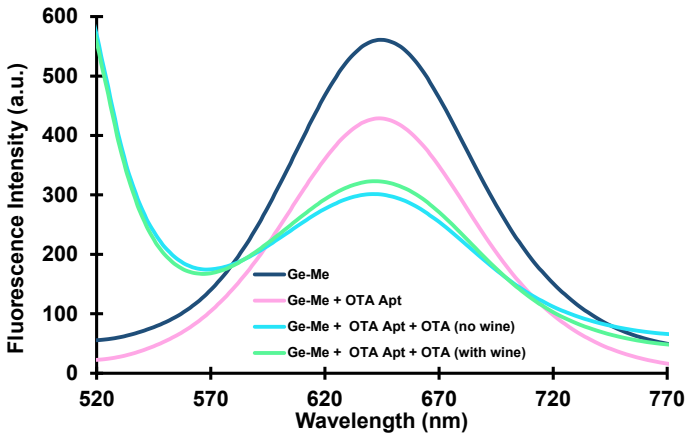

Figure S5: Application of developed biosensing assay towards the use of red wine samples spiked with 10 µM incubated with 1 mg/mL of Ge-Me with 150 nM OTA Aptamer, displayed in the form of Fluorescence emission spectra.

Table S2: Results of standard additions method to calculate the recoveries in the real sample matrix (red wine).

Sample	**Average**	**Recovery**
OTA without Wine	298±4	92.4%
OTA with Wine	323±3	