**Supporting Information**

# Sparingly soluble constant carbonate releasing inert monolith for enhancement of antimicrobial silver action and sustainable utilization

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**Supporting information 1:**

Characterization of microstructure and chemical composition of the sustained release monolith, $C_{CO_3/K}$

**Supporting information 2:**

Spectroscopy and diffraction studies of the monolith, $C_{CO_3/K}$

**Supporting information 3:**

Kinetics of sustained ion release and biocidal enhancement property of the composite, $C_{CO_3/K}$

**Supporting information 4:**

Stability of silver ions in the test water.

**Supporting information 1**

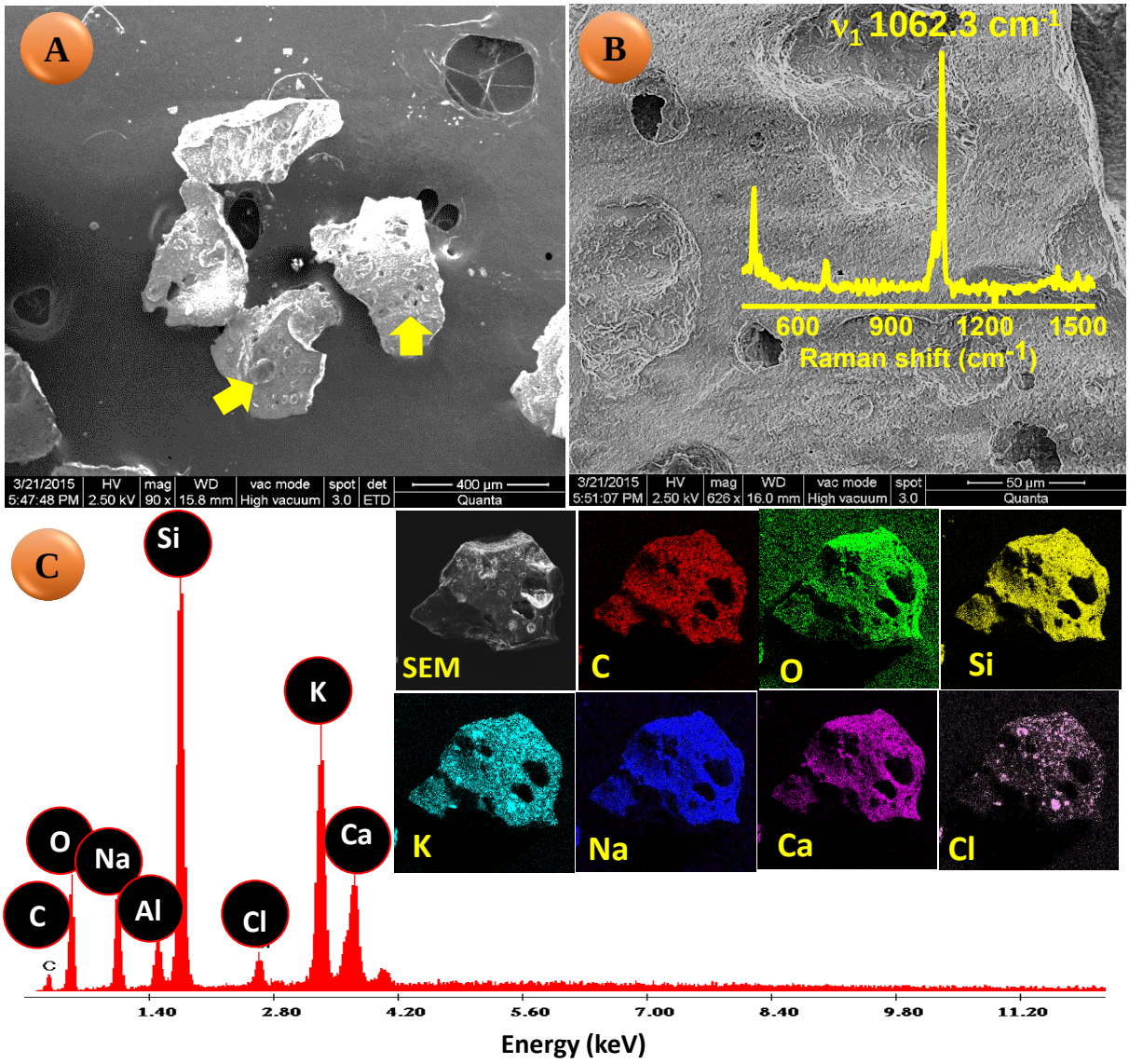



**Figure S1.** Characterization of microstructure and chemical composition of $C_{CO_3/K.}$ (A and B) Scanning electron microscopic (SEM) images of ~72 µm granules of the monolith loaded with $CO_3^{2-}$ and $K^+$. The image in panel B shows the porous surface of the granule with the inset representing the Raman feature specific for carbonate. (C) A corresponding EDS and elemental maps (in the inset).

**Supporting information 2**

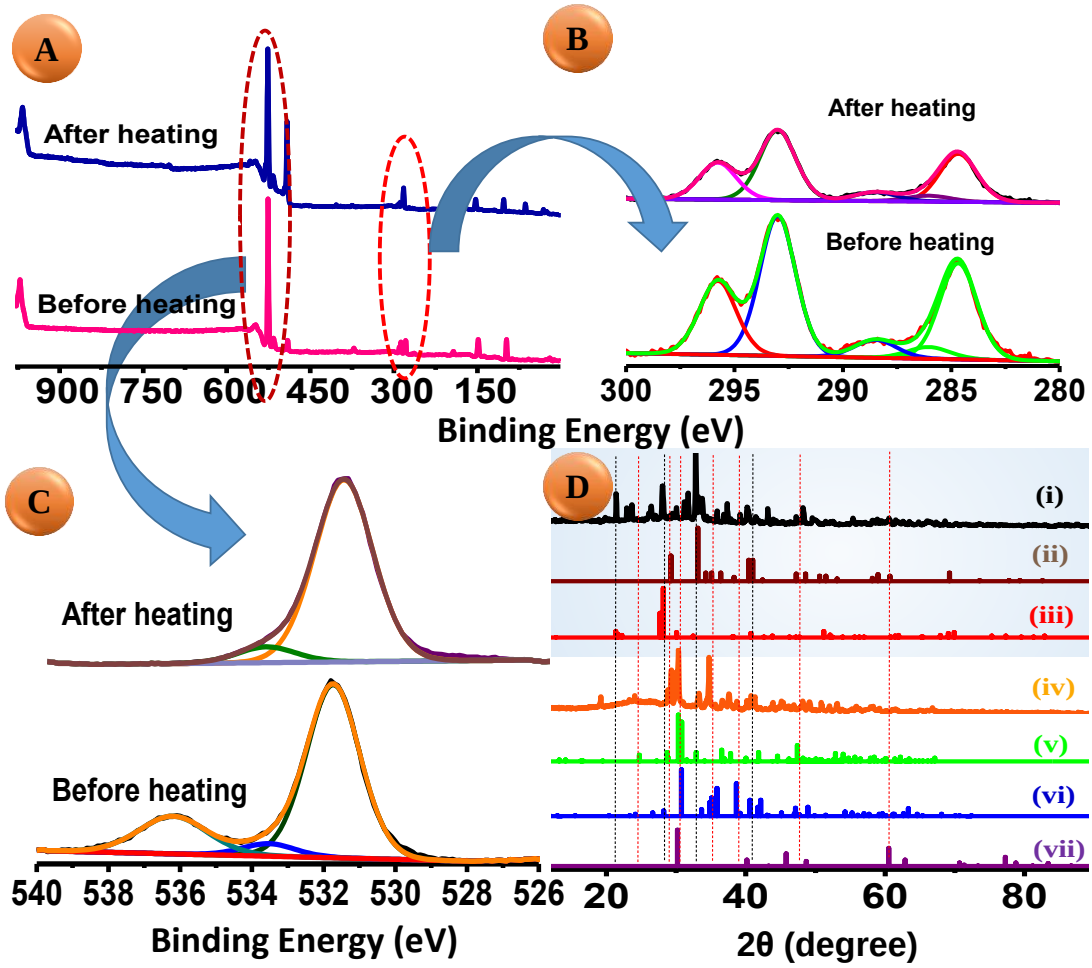
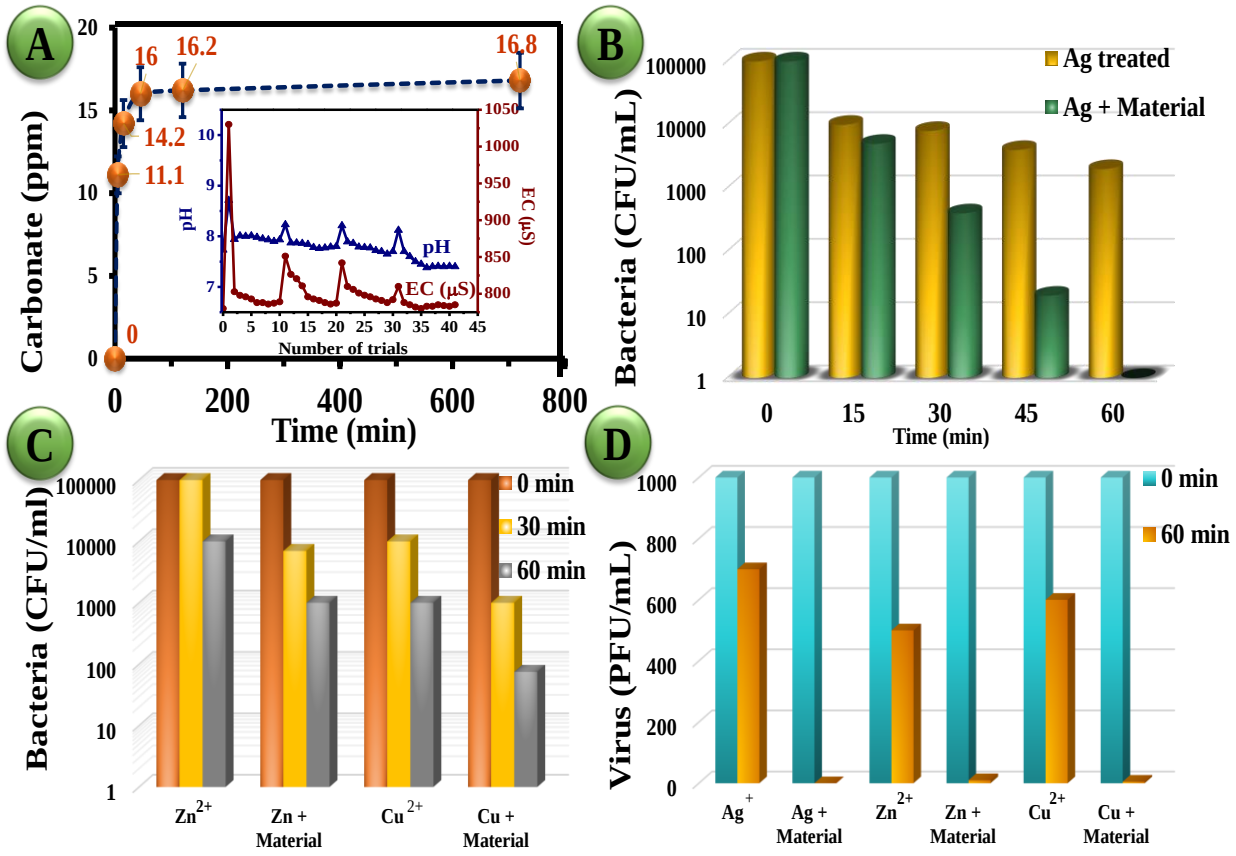



**Figure S2.** Spectroscopy and diffraction studies of $C_{CO_3/K.}$ (A) XPS survey spectra of the amended granular particles of the monolith loaded with $CO_3^{2-}$ and $K^+$, before and after heating. (B) and (C) Deconvoluted XPS spectra of carbon and oxygen, respectively. (D) Powder XRD pattern of the material before heating and after heating. The material $C_{CO_3/K}$ formed after heating (i) is compared with the (ii) moganite phase of $SiO_2$ [JCPDS 38-360] and (iii) potassium sodium carbonate [JCPDS 1-1038]. The composition before heating (iv) is compared with (v) monoclinic phase of $K_2CO_3$ [JCPDS 16-820], (vi) monoclinic phase of $Na_2CO_3$ [JCPDS 19-1130] and (vii) tetragonal phase of $SiO_2$ [JCPDS 15-0026].




**Supporting information 3**

**Figure S3.** Kinetics of sustained ion release and biocidal enhancement property of the $C_{CO_3/K}$. (A) Kinetics of carbonate release and potassium release from the modified material for prolonged period of exposure to water. Inset shows the sustained release of carbonate in continuous flow of water. (B) Sustained release of cations. (C) Carbonate-supported antibacterial activity of 50 ppb silver, 1 ppm zinc and 500 ppb copper. (D) Carbonate-supported antiviral activity of 50 ppb silver, 1 ppm zinc and 500 ppb copper.

**Supplementary Figure S4**

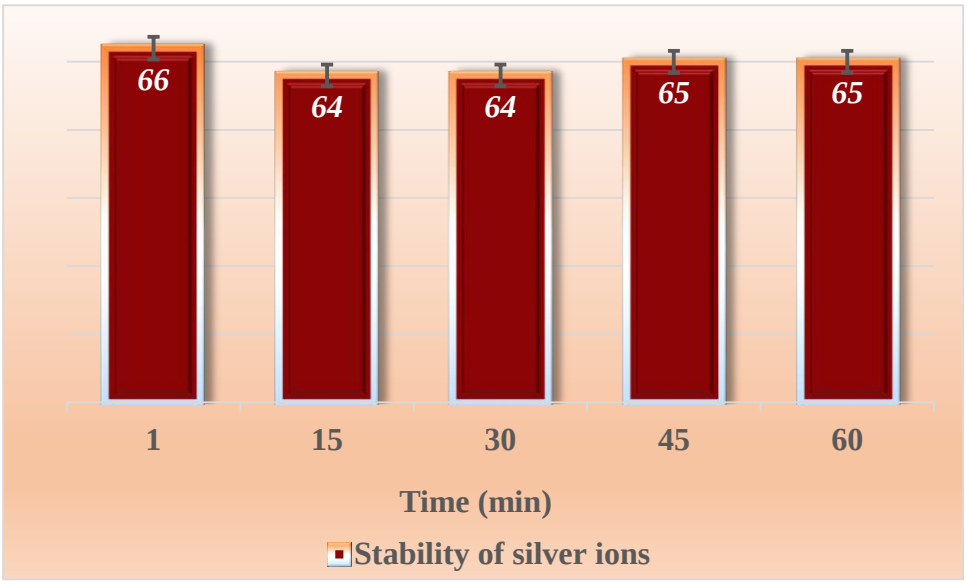



**Figure S4.** Stability of silver ions in the test water. Concentration of silver ions in ppb available in solution as a function of time. Experiments have been done to assess the concentration after centrifugation to ensure that the estimation is for the species in solution.