Supplementary data

Section 1: Experimental synthesis of BAM: Eu

By altering the ratio of each compound, BAM phosphors were created from the mixture of $BaCO_3$, MgO, α-Al_2O_3, and Eu_2O_3. Every material utilized was analytical grade and more than 99.9% pure. The thoroughly combined mixture was baked for one hour at 1400–1420 °C in an atmosphere of H_2 (6%), N_2 (94%), and oxygen. After being thoroughly ground, the baked sample was baked once more using the same process. The product was then repeatedly cleaned with deionized water after being crushed in a ball mill. Following 48 hours of drying at 120 °C, the BAM: Eu is obtained.

Section 2: Detailed Synthesis Protocol:

Step 1: Optimization of Ag^+ alloyed $Cs_2NaInCl_6$

To synthesis the optimised $Cs_2Na_{(1-x)}Ag_xInCl_6$, 2 mmol of Nacl, 2 mmol of $Incl_3$ and different mmol of AgCl (x= 0.2, 0.4, 0.6, 0.8, 1) is taken and it is dissolved in 20ml conc. Hcl to prepare the precusor solution. This reaction temperature is maintained at 80°C throughout the reaction temperature. After the precursor materials were dissolved completely in HCl, 4 mmol solution of CsCl was added to the clear solution under constant stirring, white precipitate was formed. For an hour, the reaction was allowed to stir. The reaction mixture was centrifuged and as obtained filtrate was then stored in hot air oven for 8 hours at 60°C for drying.

Step 2: Optimization of Bi^{3+}in $Cs_2Na_{(1-x)}Ag_xInCl_6$

After obtaining of optimised sample of $Cs_2Na_{(1-x)}Ag_xInCl_6$ through the observation of emission spectra maximum of photoluminescence spectroscopy, 0.4 mmol of Ag^+ is kept constant and different mmol of Bi^{3+} is used to optimise $Cs2Na_{(1-x)}Ag_xIn_{(1-y)}Bi_yCl6$. The precusor solution in 20ml Hcl is prepared through the same procedure mentioned above and $BiCl_3$ (y= 0, 0.1, 0.3, 0.5 and 0.7) is also dissolved into the precusor solution. 4 mmol solution of CsCl was added to the clear solution under constant stirring, white precipitate was formed. For an hour, the reaction was allowed to stir. The reaction mixture was centrifuged and as obtained filtrate was then stored in hot air oven for 8 hours at 60°C for drying.

Step 3: Optimization of Mn^{2+} doped $Cs_2Na_{(1-x)}Ag_xIn_{(1-y)}Bi_yCl_6$

After obtaining of optimised sample of $Cs_2Na_{(1-x)}Ag_xIn_{(1-y)}Bi_yCl_6$ through the observation of emission spectra maximum of photoluminescence spectroscopy. 0.4 mmol of Ag^+ and 0.1 mmol of Bi^{3+} is kept constant. $Cs_2Na_{(1-x)}Ag_xIn_{(1-y)}Bi_yCl_6$: $_xMn^{2+}$ is synthesised by dissolving the different mmol of Mn^{2+}(x= 0.07, 0.11, 0.15, 0.18 and 0.21) into the $Cs_2Na_{(1-x)}Ag_xIn_{(1-y)}Bi_yCl_6$ precusor solution. 4 mmol solution of CsCl was added to the clear solution under constant stirring, white precipitate was formed. For an hour, the reaction was allowed to stir. The reaction mixture was centrifuged and as obtained filtrate was then stored in hot air oven for 8 hours at 60°C for drying

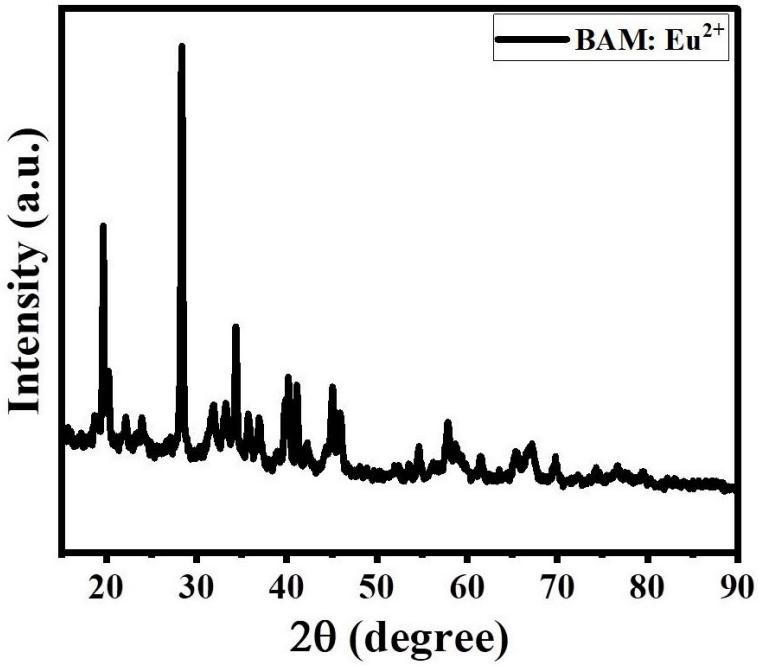

Figure S1: a) X-Ray Diffraction of BAM: Eu

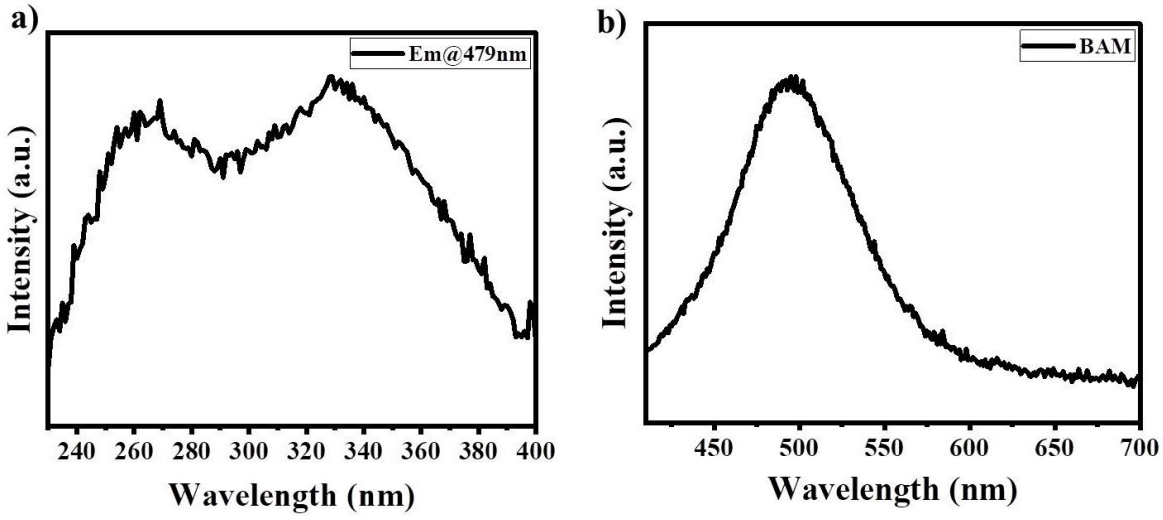

Figure S2: a) PLE of BAM and b) PL emission spectrum of BAM

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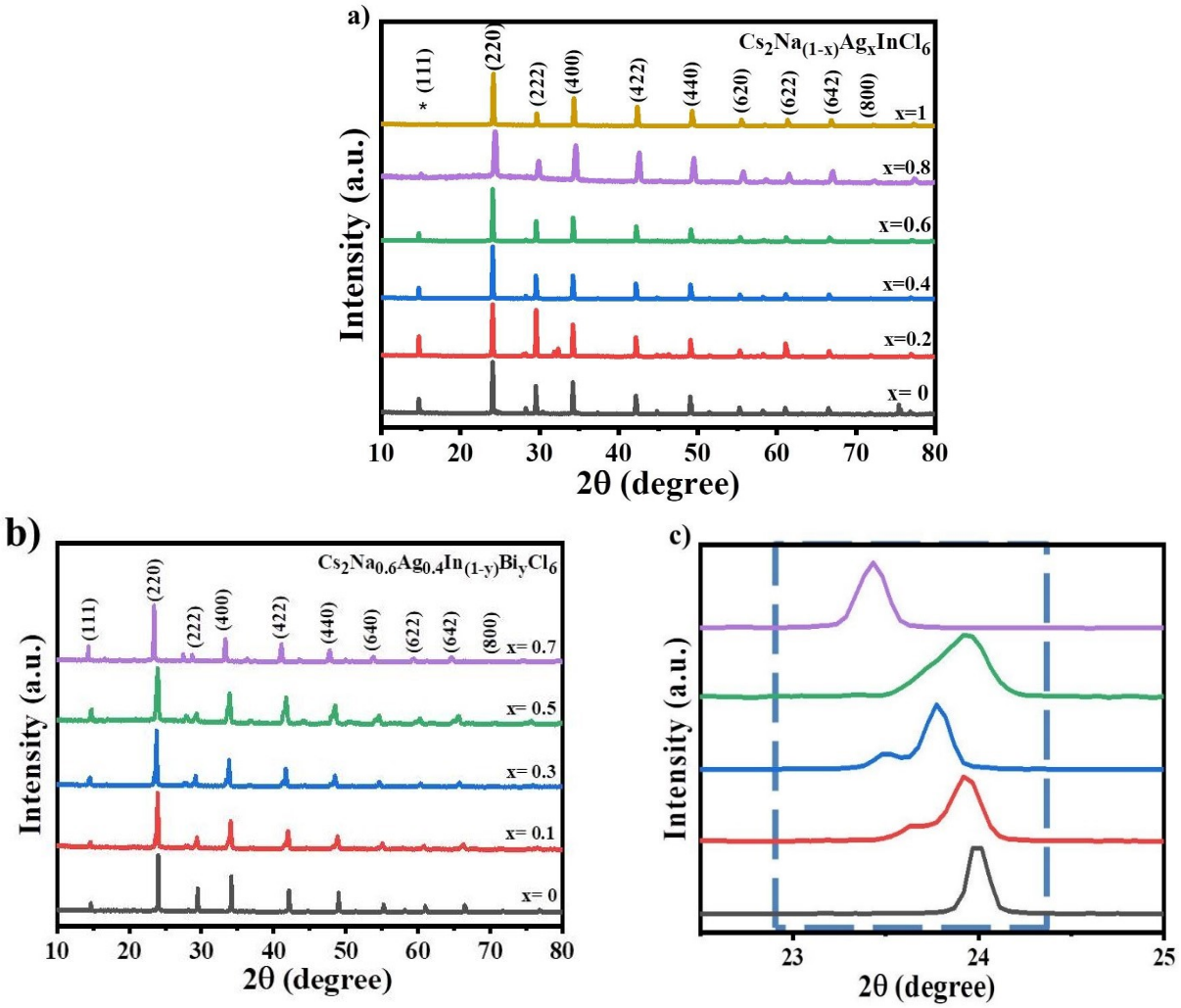
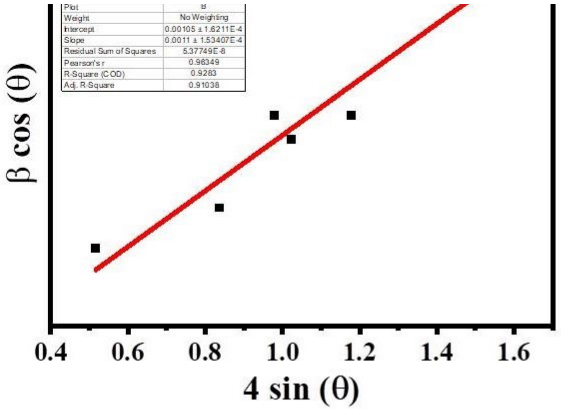
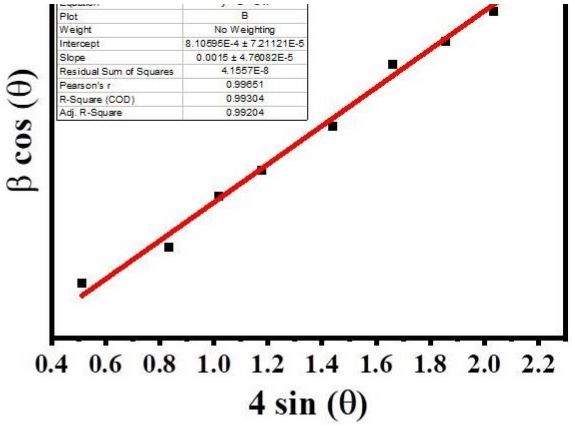
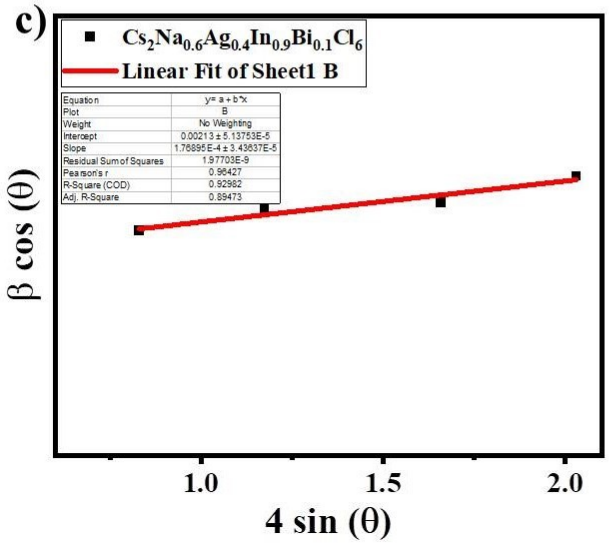


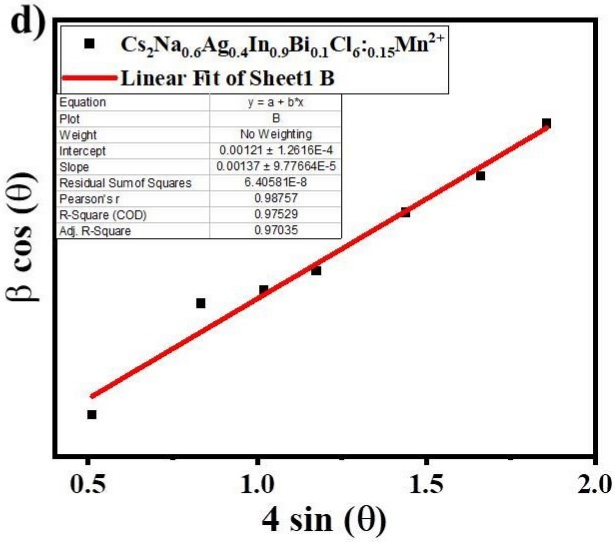
Figure S3: a) XRD of Ag^{+} variation, b) Bi^{3+} variation and c) Shit in Bi^{3+} variation

Figure S4: a) W- H plot of $Cs_2NaInCl_6$, b) $Cs_2Na_{0.6}Ag_{0.4}InCl_6$, c) $Cs_2Na_{0.6}Ag_{0.4}In_{0.9}Bi_{0.1}Cl_6$, and d) $Cs_2Na_{0.6}Ag_{0.4}In_{0.9}Bi_{0.1}Cl_6$: $_{0.15}Mn^{2+}$









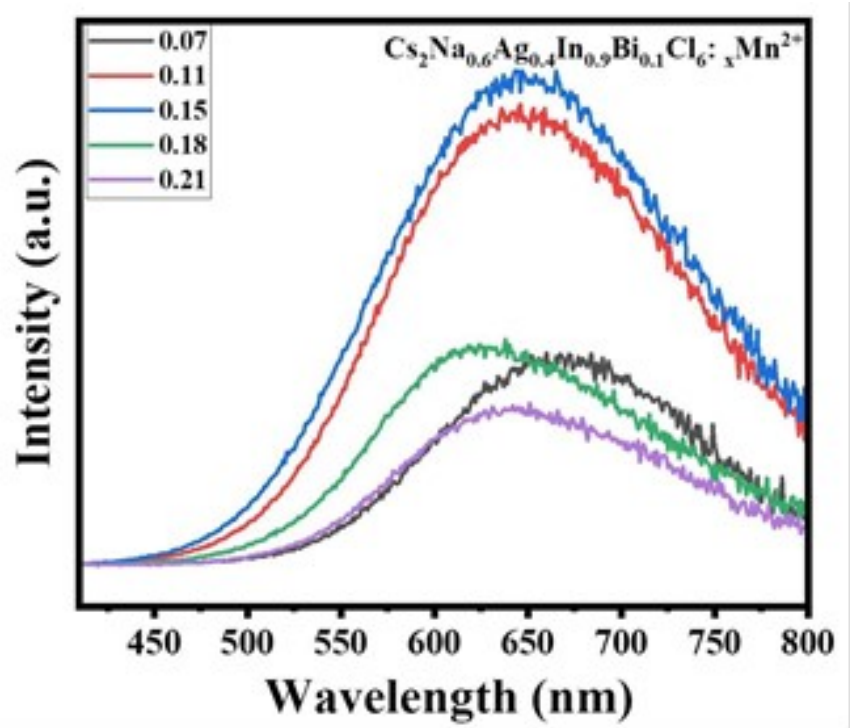


Figure S5: Room temperature photoluminescence emission spectra of the $Cs_2Na_{0.4}Ag_{0.6}In_{0.9}Bi_{0.1}Cl_6:{}_xMn^{2+}$ samples with varying concentration of Mn^{2+} ions

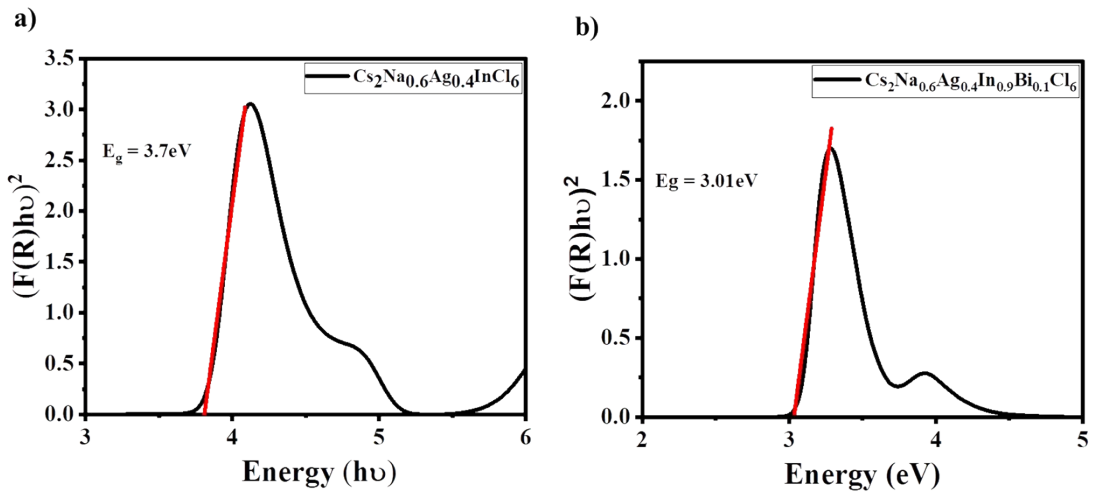


Figure S6 : a) Tauc Plot of $Cs_2Na_{0.6}Ag_{0.4}InCl_6$ and b) $Cs_2Na_{0.6}Ag_{0.4}In_{0.9}Bi_{0.1}Cl_6$

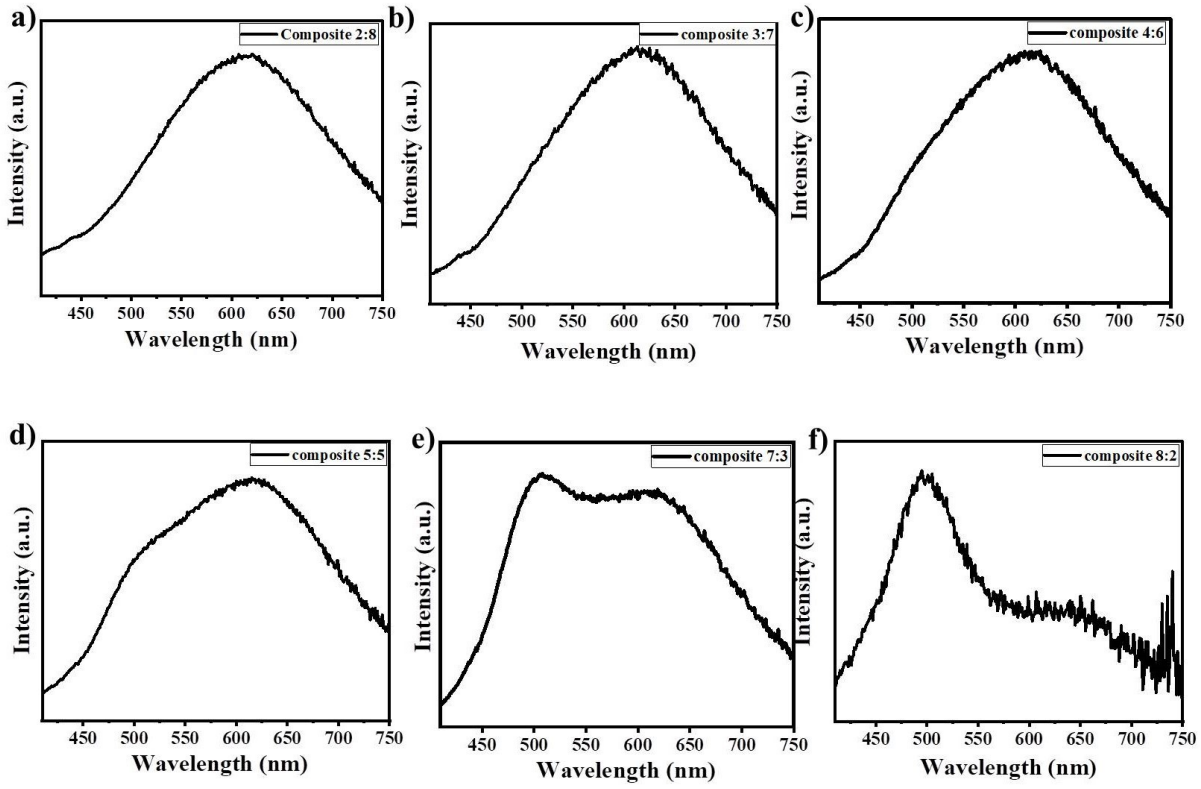


Figure S7: a)- f) PL emission spectra of different composite ratio of BAM: DPs

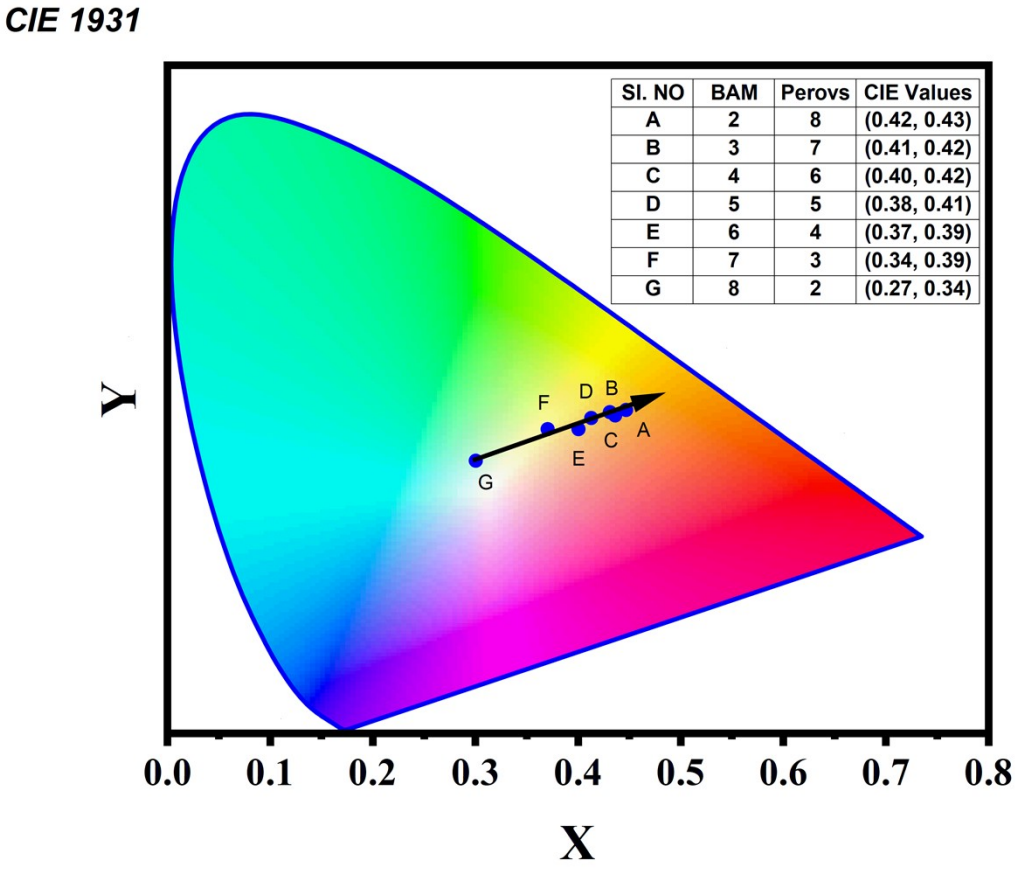


Figure S8: CIE of different composite ratio of BAM: DPs

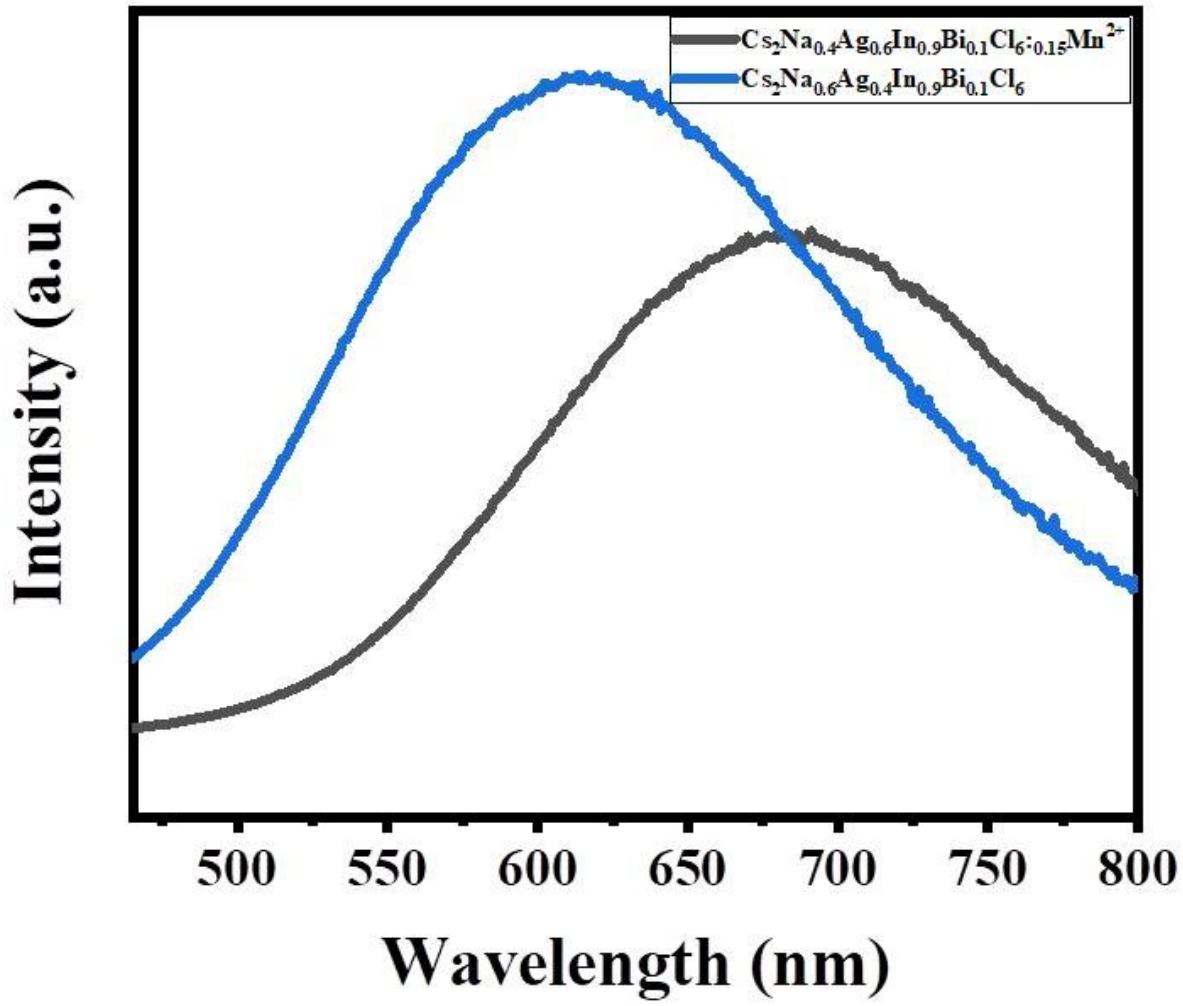


Figure S9: Emission spectra of optimised host lattice with and without Mn^{2+} doping. Concentration of Mn^{2+} is 0.15 mmol

Table S1: PLQY of $Cs_2NaInCl_6$, $Cs_2Na_{0.6}Ag_{0.4}InCl_6$, $Cs_2Na_{0.6}Ag_{0.4}In_{0.9}Bi_{0.1}Cl_6$, and $Cs_2Na_{0.6}Ag_{0.4}In_{0.9}Bi_{0.1}Cl_6:{}_{0.15}Mn^{2+}$

Perovskites	PLQY
$Cs_2NaInCl_6$	1.8%
$Cs_2Na_{0.6}Ag_{0.4}InCl_6$	22.1%
$Cs_2Na_{0.6}Ag_{0.4}In_{0.9}Bi_{0.1}Cl_6$	29.4%
$Cs_2Na_{0.6}Ag_{0.4}In_{0.9}Bi_{0.1}Cl_6:{}_{0.15}Mn^{2+}$	44.9%