

Electronic Supplementary Information (ESI)

Multi-functionalized NiCo₂O₄ spinel heterostructure by hydrothermal route for high performance photo-electrocatalytic, anti-bacterial and eco-toxicity applications

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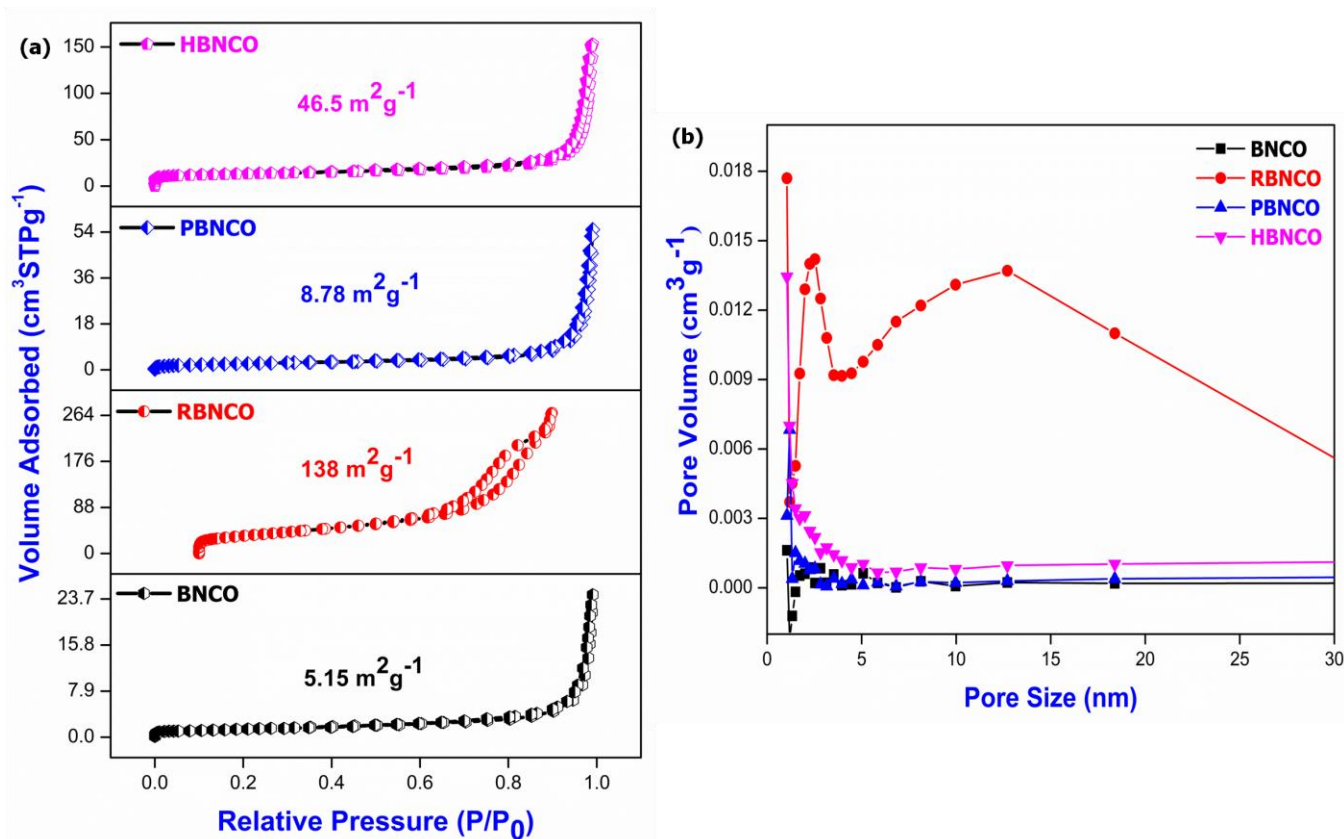


Figure S1 (a) N₂ Adsorption/Desorption isotherms and (b) BJH plots of nanocomposites

Table S1 Surface properties of synthesized nanocomposites

S. No	Material	BET specific surface area (m ² /g ⁻¹)	Pore volume (cm ³ /g ⁻¹)	Pore size (nm)	DLS				
					Particle size (nm)	PDI	Zeta potential (mV)	Dispersant & refractive index	Sample preparation method
1	BNCO	5.15	0.0343	28.848	252.7 ± 1.9	0.466	-35.9	Water (1.333)	Ultra-sonication
2	RBNCO	138.0	0.405	10.614	242.5 ± 1.2	0.522	-35.6		
3	PBNCO	8.78	0.0788	23.692	257.1 ± 3.6	0.766	-32.8		
4	HBNCO	46.5	0.2144	21.101	248.5 ± 2.3	0.529	-34.9		

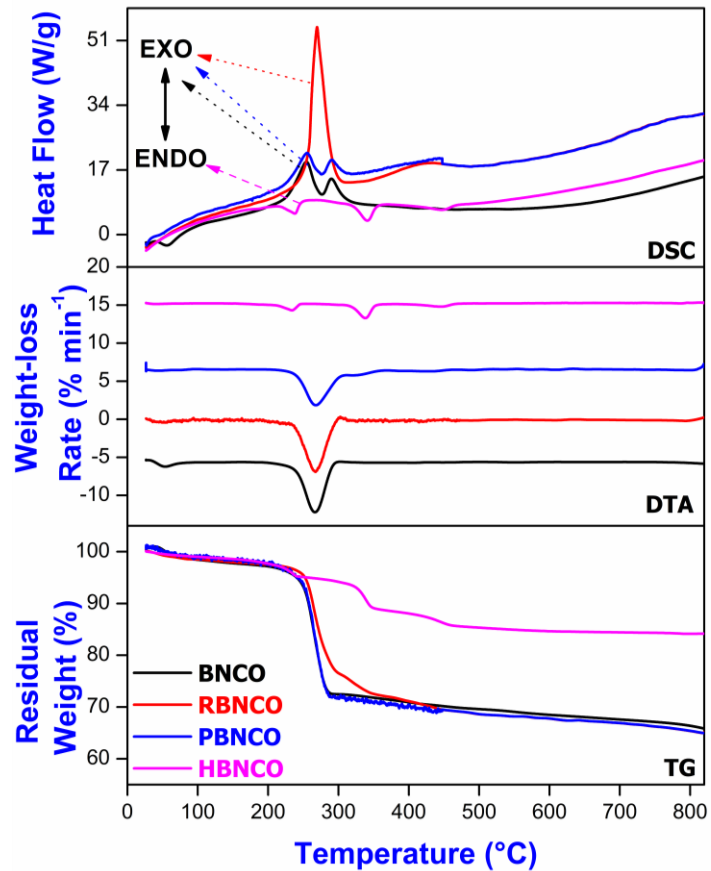


Figure S2 TG/DTA of synthesized mixed oxide catalysts

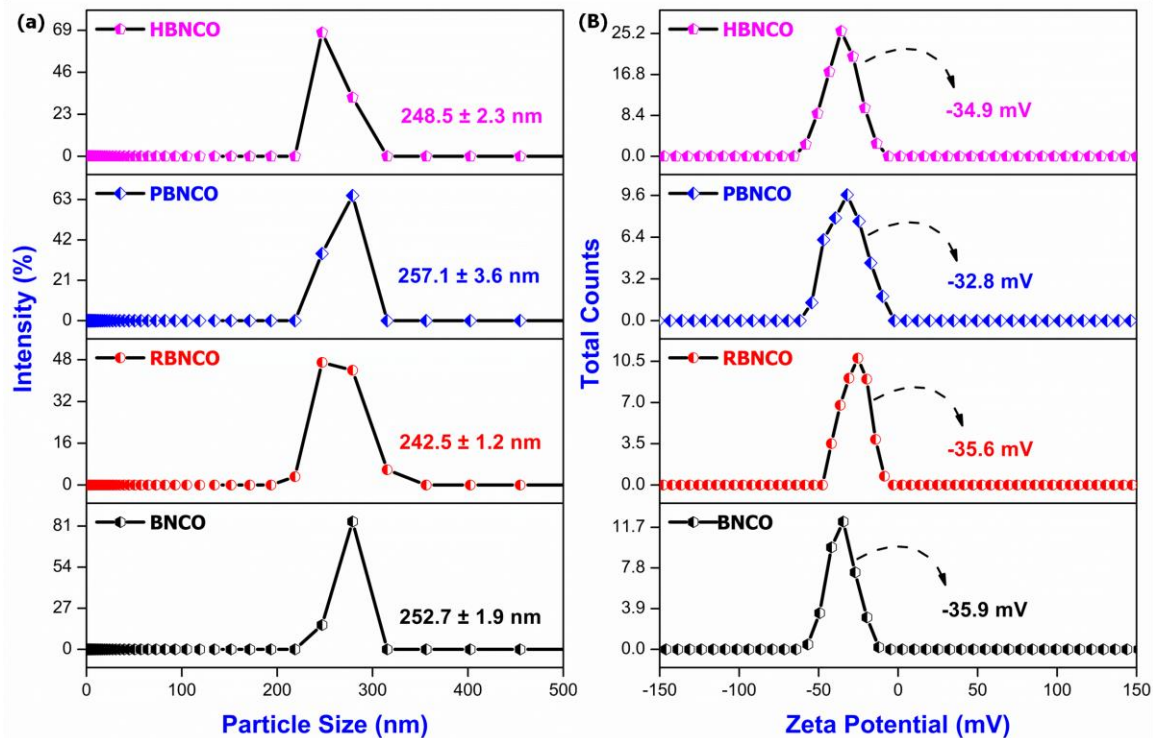


Figure S3 (a) Hydrodynamic particle size and (b) Zeta potential of nanocomposites

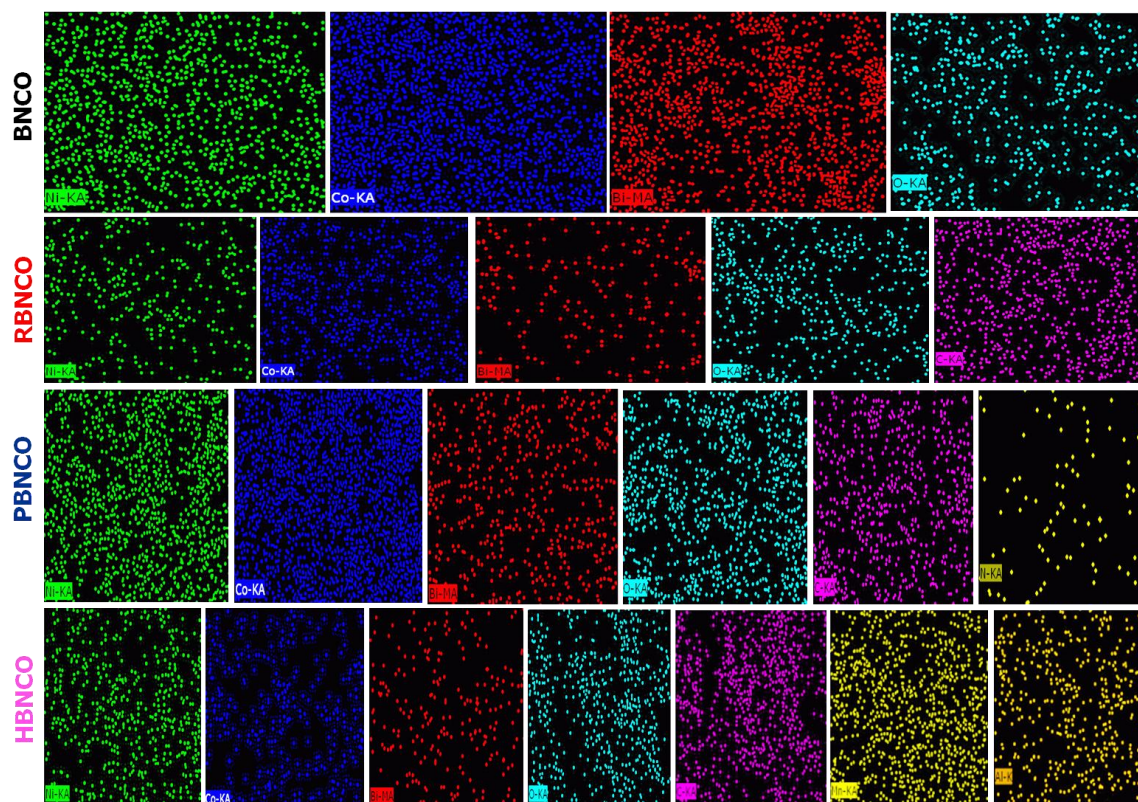


Figure S4 Elemental mapping of composites

Table S2 Electrochemical measurements for mixed composites

S. No	Material	Overpotential (η) (mV) at 10 mA cm^{-2}	Tafel slop (mV dec^{-1})	C_{dl} ($\mu\text{F cm}^{-2}$)	ECSA (cm^2)	R_{ct} (Ω)	TOF s^{-1}
1.	BNCO	377	81	9.457	0.2364	3.75	0.0343
2.	RBNCO	329	66	18.391	0.4597	2.80	0.5030
3.	PBNCO	450	122	14.251	0.3562	4.06	0.0196
4.	HBNC0	360	73	14.679	0.3669	3.25	0.1372

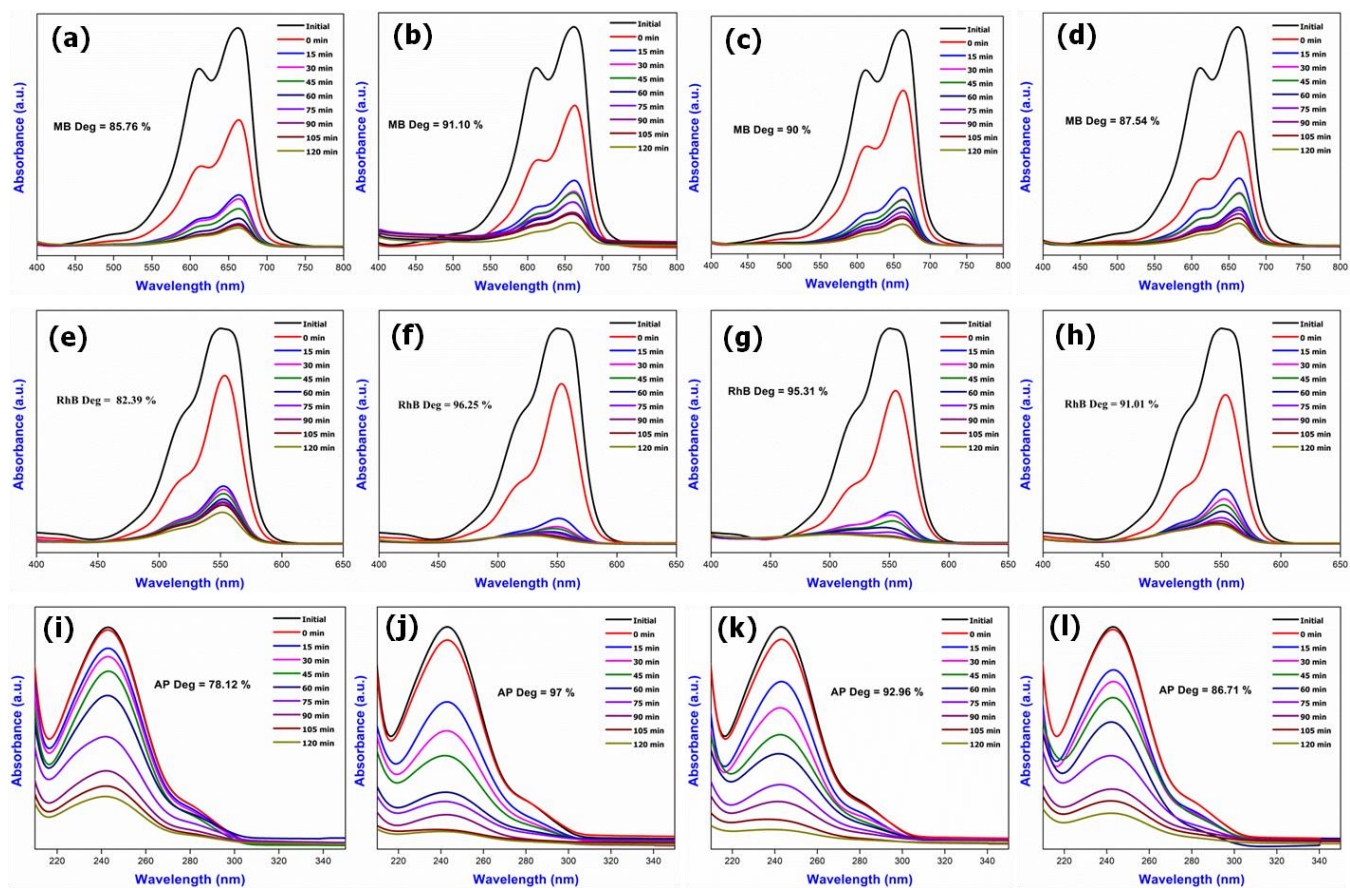


Figure 5S shows UV graphs for photocatalytic degradation of (a-d) MB, (e-h) RhB and (i-l) AP using four composites of BNCO, RBNCO, PBNCO and HBNC0 NCS

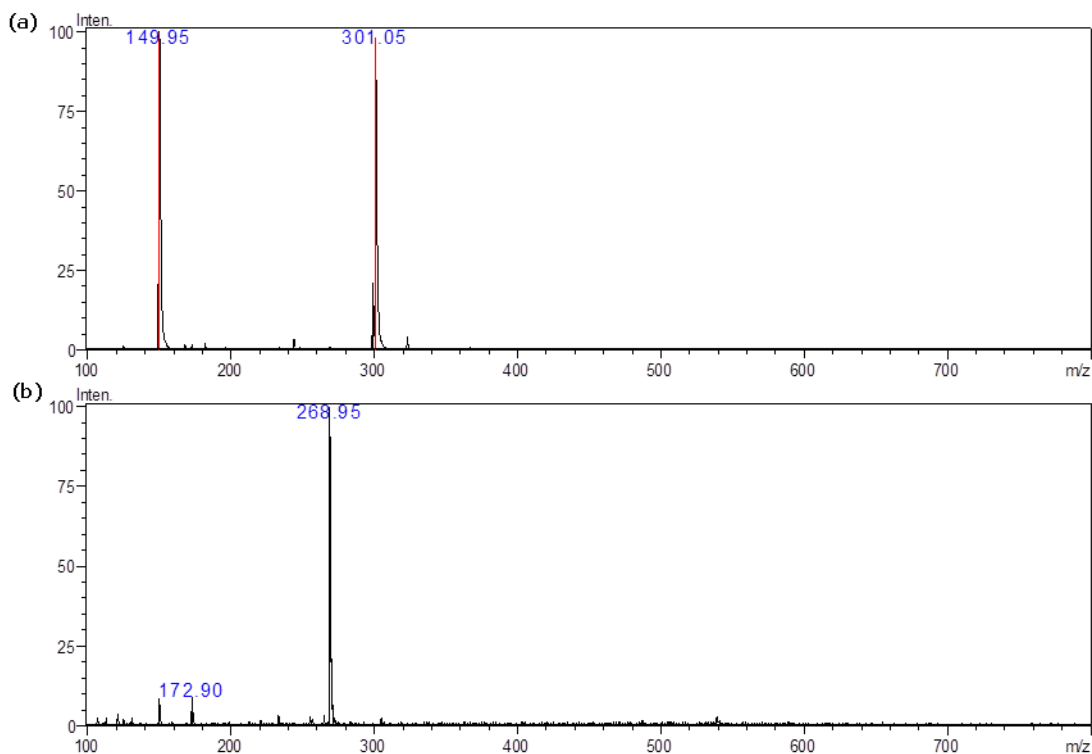


Figure S6 LC-MS analysis of (a) Before and (b) After the photocatalytic treatment of acetaminophene drug

Table S3 Rate constant and R^2 values for photocatalysts

S. No	Materials	Pseudo-first-order kinetic model					
		MB		RhB		Acetaminophene	
		Rate constant (min^{-1})	R^2 value	Rate constant (min^{-1})	R^2 value	Rate constant (min^{-1})	R^2 value
1.	BNCO	0.01243	0.8557	0.01122	0.7192	0.01108	0.8500
2.	RBNCO	0.01583	0.8975	0.02198	0.8801	0.02286	0.9424
3.	PBNCO	0.01454	0.8765	0.02139	0.8404	0.01869	0.9169
4.	HBNCO	0.01314	0.806	0.0161	0.7671	0.01445	0.8819

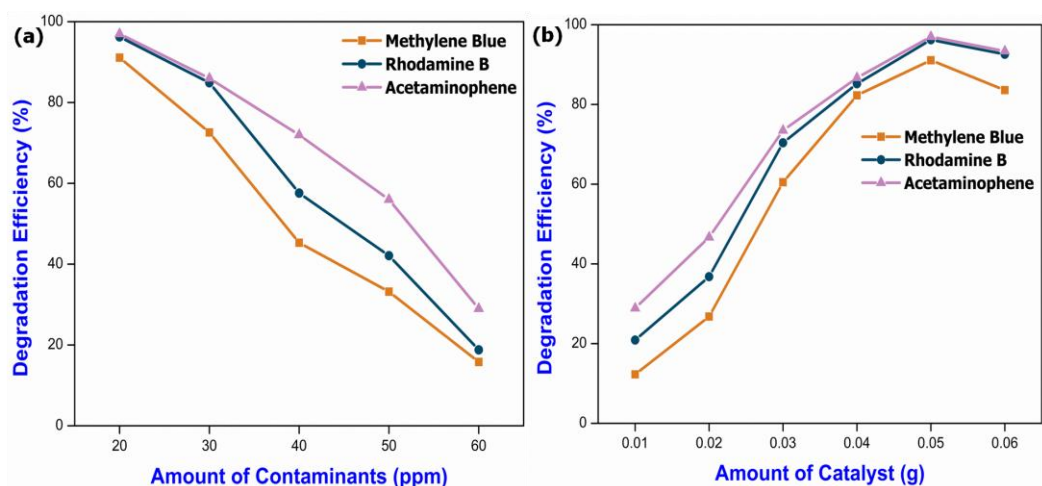


Figure S7 (a) Effect of concentration, (b) Effect of catalyst dosage on photocatalytic degradation efficiency using RGO@Bi₂O₃/NiCo₂O₄ NCs

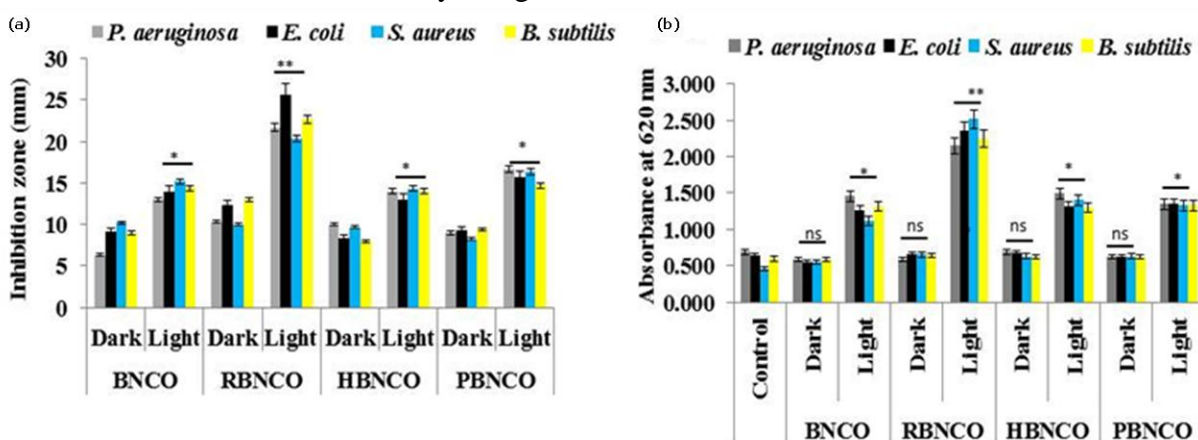


Figure S8 Bar graphs of (a) zone of inhibition and (b) ROS production induced by nanocomposites in selected bacterial strains. ** p < 0.01 vs. dark, ns-not significant Vs. control

Table S4 Minimum Inhibitory Concentrations (MICs; $\mu\text{g mL}^{-1}$) and Minimum Bactericidal Concentrations (MBCs; $\mu\text{g mL}^{-1}$) of nanocomposites

Nanocomposite	Condition	<i>B. subtilis</i>		<i>S. aureus</i>		<i>E. coli</i>		<i>P. aeruginosa</i>	
		MIC	MBC	MIC	MBC	MIC	MBC	MIC	MBC
RBNCO	Dark	14	17	13	15	114	14	16	14
	Light	24	5	3	4	3	5	6	37
HBNCO	Dark	14	19	9	17	10	16	12	14
	Light	6	8	3	6	3	7	4	5
PBNCO	Dark	19	19	17	17	17	17	15	15
	Light	8	8	6	7	6	8	3	5
BNCO	Dark	10	10	9	19	14	16	17	17
	Light	6	7	5	4	7	8	7	7