Rank	Pigment Code (C.I. Name)	Chemical Class	Opacity & Covering Power	UV Lightfastness (BWS)	Migration Resistance	Eco-Toxicity & Biodegradability Profile	Shade
			White				
1 (Best)	PW6	Titanium Dioxide (TiO_2)	Outstanding (High refractive index $n \approx 2.7$)	Outstanding (BWS 8)	Perfect (GS 5)	Completely inert mineral; non-toxic and allowed under EN 13432.	
2	PW4	Alumina Trihydrate / Aluminum Oxide	Low to Moderate (Used primarily as an inert filler or base)	Outstanding (BWS 8)	Perfect (GS 5)	Safe, non-toxic mineral, but lacks the high opacity of TiO_2.	
			Yellow				
1 (Best)	PY138	Quinophthalone Yellow	Moderate (Semi-opaque; requires TiO_2 addition for full opacity)	Excellent (BWS 7-8)	Excellent (GS 5)	Heavy-metal-free, diarylide-free, and EN 13432 certified.	
2	PY139	Isoindoline Yellow	Moderate (Transparent to semi-opaque; reddish-yellow hue)	Excellent (BWS 7-8)	Excellent (GS 5)	Halogen-free, heavy-metal-free, and certified compostable.	
3	PY42	Yellow Iron Oxide ($Fe_2O_3 \cdot H_2O$)	Excellent (Good scattering and high absorption)	Outstanding (BWS 8)	Perfect (GS 5)	Natural mineral; completely safe and non-toxic, though shade is a muted earth tone.	
4	PY184	Bismuth Vanadate	Excellent (Matches cadmium-like opacity)	Outstanding (BWS 8)	Perfect (GS 5)	Heavy metal restrictions do not explicitly ban bismuth or vanadium under EN 13432, but toxicity concerns limit its use.	
Not Allowe	PY13 / PY83	Diarylide Yellow	Moderate	Poor to Moderate	Poor to Moderate	Restricted; thermally degrades at processing temperatures, releasing carcinogenic PAAs.	
			Orange				
1 (Best)	PO64	Benzimidazolone Orange	Moderate to High (Semi-opaque with high color saturation)	Excellent (BWS 7-8)	Perfect (GS 5, low migration)	Halogen-free, heavy-metal-free, and certified compostable under EN 13432.	
2	PO73	Pyrrole Orange (DPP)	Moderate (Semi-transparent to semi-opaque)	Excellent (BWS 7-8)	Excellent (GS 5)	Extremely stable and non-toxic high-performance organic pigment.	
3	PO48	Quinacridone Burnt Orange	Low (Highly transparent; best suited for glazing)	Excellent (BWS 7-8)	Perfect (GS 5)	Safe, non-toxic organic pigment, but lacks covering power.	
Not Allowe	PO13	Diarylide Orange	Moderate	Poor	Poor	Restricted due to the risk of carcinogenic PAA generation and thermal instability.	
			red				
1 (Best Red)	PR178	Perylene Red	High (Very good covering power)	Excellent (BWS 7-8)	Perfect (GS 5)	Heavy-metal-free, halogen-free, and certified compostable under EN 13432.	
2 (Red)	PR254	Diketopyrrolopyrrole (DPP Red)	Outstanding (Highly opaque and brilliant)	Outstanding (BWS 8)	Perfect (GS 5)	Extremely stable synthetic organic pigment with excellent safety; highly recommended for industrial coatings.	
3 (Red-Brown)	PR101	Red Iron Oxide (Fe_2O_3)	High (Semi-opaque to opaque)	Outstanding (BWS 8)	Perfect (GS 5)	Natural or high-purity synthetic mineral; highly sustainable and non toxic, though shade is earthy.	
1 (Best Pink)	PR122	Quinacridone Pink/Magenta	Low (Transparent; must be combined with TiO_2 for pink shades)	Excellent (BWS 7-8)	Perfect (GS 5, zero bleed)	High chemical purity, certified compostable, and highly safe for sensitive applications.	
			Violet				
1 (Best)	PV37	Dioxazine Violet (Chlorine-Free)	Low to Moderate (Highly transparent; high tinting strength)	Excellent (BWS 7-8)	Perfect (GS 5)	Chlorine-free and halogen-free; certified compostable under EN 13432.	
2	PV19	Quinacridone Violet	Low (Transparent)	Excellent (BWS 7-8)	Perfect (GS 5)	Highly stable and non-toxic organic pigment with excellent safety.	
3	PV23	Carbazole Violet	Moderate	Excellent (BWS 7-8)	Excellent (GS 5)	Excellent performance, but contains organically bound chlorine, raising halogen-restriction concerns.	
			Blue				
1 (Best)	PB16	Metal-Free Phthalocyanine Blue	Low (Transparent; greenish-blue shade)	Excellent (BWS 7-8)	Perfect (GS 5)	Completely copper-free and halogen-free; EN 13432 certified.	
2	PB79	Aluminum Chlorophthalocyanine	Moderate (Greenish-blue shade)	Excellent (BWS 7-8)	Perfect (GS 5)	Uses allowed aluminum (Al) rather than restricted copper (Cu); highly stable.	
3	PB29	Ultramarine Blue	Low (Transparent; reddish-blue shade)	Excellent (BWS 7-8)	Perfect (GS 5)	Extremely safe sodium alumino-sulfosilicate mineral, but has poor acid resistance.	
4	PB60	Indanthrone Blue	Low (Highly transparent; dark indigo shade)	Outstanding (BWS 8)	Perfect (GS 5)	Copper-free, but its structural similarity to anthraquinones raises potential carcinogenicity concerns.	
Not Allowe	PB15	Copper Phthalocyanine Blue	Low	Outstanding (BWS 8)	Perfect (GS 5)	Restricted; contains high levels of complexed copper that exceed the EN 13432 50 ppm limit.	
			Green				
1 (Best Vivid)	Co-precipitated Blend	PB16 or PB79 + PY138 or PY139	Moderate (Vivid, clean green shade)	Excellent (BWS 7-8)	Perfect (GS 5)	Completely copper-free and halogen-free; designed to avoid toxic heavy metal restrictions.	mix
2 (Muted)	PG8	Naphthol Green B	High (Yellowish-green/olive shade with strong hiding power)	Good (BWS 6-7)	Perfect (GS 5, zero migration)	Sodium ferric complex (Fe-based); contains allowed iron and is safe for agricultural soils.	
3 (Dark/Shadow)	PBk31	Perylene Green (Perylene Black)	Low (Transparent; dark shadow green)	Excellent (BWS 7-8)	Perfect (GS 5)	Safe and non-toxic perylene chemistry; excellent for deep forest and shadow greens.	
Not Allowe	PG17	Chromium Oxide Green	Outstanding	Outstanding (BWS 8)	Perfect (GS 5)	Restricted; contains chromium that exceeds the EN 13432 50 ppm limit.	
Not Allowed	PG7 / PG36	Copper Phthalocyanine Green	Low to Moderate	Outstanding (BWS 8)	Perfect (GS 5)	Restricted; high copper content exceeds the EN 13432 50 ppm limit.	
			Black				
Rank	Pigment Code (C.I. Name)	Chemical Class	Opacity & Covering Power	UV Lightfastness (BWS)	Migration Resistance	Eco-Toxicity & Biodegradability Profile	
1 (Best Bio)	BP7	Bio-based carbon blacks	High (Matches the jetness of fossil carbon black)	Outstanding (BWS 8)	Perfect (GS 5)	Made from waste streams (printex nature 35 PWD)	
2 (Mineral)	PBk11	Black Iron Oxide (Fe_3O_4)	Outstanding (High opacity and tinting strength)	Outstanding (BWS 8)	Perfect (GS 5)	Natural mineral; non-toxic and permitted under composting regulations.	
3	PBk1	Aniline Black	Moderate	Moderate to Good	Moderate	Synthetic organic alternative with lower weatherability and hiding power than iron oxide.	

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