

Why Regular Car Cleaning Is About Protection, Not Just Appearance: The Science Behind Automotive Surface Damage

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Details:

AI Summary

****Product:**** Selleys Polyglaze Automotive Care Range ****Brand:**** Selleys ****Category:**** Automotive Surface Protection and Cleaning Products ****Primary Use:**** Surface-specific chemical protection against UV degradation, acid etching, tar bonding, ozone cracking, and oxidation across all automotive surfaces

Quick Facts - ****Best For:**** Car owners who want science-backed, surface-appropriate protection against active chemical and physical damage - ****Key Benefit:**** Each product targets a specific substrate and threat rather than applying one generic formula across the board - ****Form Factor:**** Multiple forms across the range (wash, liquid polish, protectant) - ****Application Method:**** Surface-specific application matched to substrate type and threat profile

Common Questions This Guide Answers 1. How quickly can bug splatter permanently damage car paint? → Within 24–48 hours at room temperature; within hours on hot days when surface temperatures reach 65–88°C 2. Why can't standard car shampoo remove road tar? → Tar is oil-based bitumen that repels water; only solvent-based dedicated tar removers can dissolve it safely 3. What causes headlight yellowing and does it affect safety? → UV radiation breaks down polycarbonate via the Photo-Fries process, creating oxidation compounds that scatter light, measurably reducing beam intensity and coverage

Why regular car cleaning is about protection, not just appearance: the science behind automotive surface damage

Most car owners wash their vehicles because a dirty car looks bad. That reasoning misses the deeper, and far more costly, truth: every contaminant sitting on your car's surfaces right now is actively degrading the material beneath it. Bug splatter is acidifying. Road tar is bonding. UV radiation is breaking molecular chains. Ozone is cracking rubber seals. The dull, stained, or faded finish you eventually see is simply the visible endpoint of damage that started hours or days earlier, at the molecular level.

This article covers the foundational science behind every smart automotive care decision you make. Understanding why surfaces degrade, and how fast, transforms car cleaning from a cosmetic habit into a rational, protective discipline. It makes every other guide in this series actionable, because you'll understand exactly what you're preventing, not just what you're cleaning.

How your car's finish is actually structured

Before examining what damages your car, it helps to understand what's being damaged.

A vehicle's finish is a layered system: the metal body sits under a primer layer, then a base coat (the actual colour), and finally a clear coat, a transparent protective layer that delivers gloss and shields the pigment underneath.

The clear coat is the primary defence layer, and also the weakest link over time. UV radiation is the dominant long-term degradation mechanism for automotive paint, and clear coats are polymer networks, typically polyurethane or acrylic-urethane systems. According to a peer-reviewed study published in [*ScienceDirect* on the photodegradation of automotive coatings](<https://www.sciencedirect.com/science/article/abs/pii/S0141391098002055>), these coatings consist usually of solvent-based thermosetting acrylic polymers crosslinked with a melamine-based resin or two-pack polyurethanes, typically cured at 130°C. To filter harmful solar radiation and prevent the substrate from undergoing fast photodegradation, the topcoat needs to contain a long-lasting UV absorber (UVA).

Prior attempts to improve UV resistance have included UV absorbers and hindered amine light stabilisers, but these organic additives are themselves susceptible to photodegradation, limiting their effectiveness over time. Even the protection built into your factory paint has a finite lifespan. What you do, or don't do, in maintenance determines how quickly that lifespan runs out.

Threat #1: Insect splatter, the acid clock starts on impact

Of all the contaminants your car encounters, insect remains are among the most chemically aggressive, and the most underestimated.

Bug splatter causes serious damage. The body fluids of insects are acidic and carry a complex mix of proteins and enzymes. When a bug hits your car at speed, this corrosive mixture spreads across the paint and immediately begins breaking down the clear coat.

The pH chemistry is well-documented. Many insects contain enzymes and acids with a pH as low as 4.2, similar to vinegar. When left untreated, bug residue can eat into the clear coat within 24 to 48 hours, leading to permanent etching and paint damage. Research cited by the University of Florida's Institute of Food and Agricultural Sciences found that smooshed Lovebugs start at a near-neutral pH of 6.5 but become acidic at 4.25 within 24 hours, a pH shift that directly correlates with the onset of clear coat etching.

The damage works two ways. The hard exoskeletons of larger insects are abrasive. When bug residue dries completely, it hardens onto the paint, and removing it without the right technique is like rubbing sandpaper across your car, causing swirls and scratches in the clear coat. So within a short window, you're dealing with chemical etching from the bug's acidic residue and physical damage from its hardened body.

Heat makes this considerably worse. On a sunny summer day, your car's surface can reach 65–88°C even when the ambient temperature is only 32°C. At those temperatures, the acidic compounds in bugs bake into the paint, intensifying the chemical reaction and accelerating damage far beyond what you'd see in cooler conditions. Researchers at the University of Florida at Gainesville have also found that UV from the sun can catalyse the etching process with certain types of bugs, like the infamous love bug.

The bug damage timeline

Time Since Impact	State of Splatter	Risk Level
0–2 hours	Wet, mostly water-soluble	Low — standard wash sufficient
2–12 hours	Proteins bonding to clear coat	Moderate — chemical pre-soak needed
12–48 hours	Acid actively etching clear coat	High — permanent etching possible
48+ hours	Baked in, hardened, deeply etched	Severe — machine polishing or panel repair

required |

Those stubborn marks that won't wash off aren't leftover bug guts. They're etchings burned into your clear coat by corrosive bug enzymes and acids. Once the reaction occurs, it doesn't sit on the surface — it eats into the paint itself.

For the correct process of removing bug splatter safely before this damage becomes permanent, see our guide on [[How to Remove Bugs and Tar from Your Car Without Damaging the Paint](#)](Not specified by manufacturer).

Threat #2: Road tar, petroleum bonding directly to your clear coat

Road tar operates through a completely different chemical mechanism from bug acids, but the outcome is equally destructive when left unaddressed.

Road tar is primarily composed of bitumen, the same sticky, black binder used in asphalt. When temperatures rise, or when road crews are laying fresh pavement, this material becomes viscous and clings readily to tyres and bodywork. Once it transfers to your vehicle, it begins to cool and harden. Over time, the volatile organic compounds (VOCs) within the tar evaporate, leaving behind a brittle, rock-hard deposit.

Those dark specks on your lower panels aren't just dirt. They're sticky hydrocarbon deposits bonding to your clear coat. Heat and UV exposure harden them fast. What starts soft becomes solid and increasingly stubborn. Over time, tar adheres more aggressively and can oxidise, potentially leaving behind discolouration even after removal.

The solvent chemistry of tar makes it particularly insidious. According to Mike Schultz, senior vice president of research and product development at Turtle Wax, "Tar is a bigger problem for vehicles in warmer weather because it becomes stickier. Natural solvents in the tar can migrate into your vehicle's paint and cause permanent stains." Tar damage can appear in as little as a week.

When tar bonds with your vehicle's paintwork, removal becomes a real challenge, and forcing it off can damage the finish. Tar on vehicles also traps moisture and road contaminants, creating conditions for rust and corrosion.

Standard car shampoo cannot dissolve bitumen because tar is oil-based and water-repellent. Dedicated tar removers use solvents to dissolve bitumen safely, allowing contamination to be removed without damaging the paint. Understanding how different contamination types respond to different chemistry is a key part of professional vehicle care, and it's where having the right product makes all the difference.

Threat #3: UV radiation, the silent, cumulative destroyer

Unlike bug acids or tar, UV radiation produces no immediate visible damage. Its destruction is cumulative, operating at the molecular level over months and years, which is precisely what makes it so dangerous.

UV rays divide into three categories: UVA, UVB, and UVC. UVA and UVB carry the greatest impact on automotive surfaces. These rays are not filtered by the atmosphere — they attack the paints and plastics used in automotive applications directly.

The mechanism is called photodegradation. UV photons penetrate the clear coat and begin breaking down chemical bonds within the polymer structure. As these bonds break, the material loses flexibility and strength. Once the polymer structure weakens, oxygen in the air reacts with the exposed material, creating oxidation that causes the clear coat to appear dull or cloudy.

A peer-reviewed study published in [*ScienceDirect* on environmental degradation of automotive clear coats](<https://www.sciencedirect.com/science/article/abs/pii/S0141391010001941>) confirmed that changes are likely due to the hydrolysis and photodegradation of polymer chains, and that degradation occurred in a top-down fashion, meaning the outermost surface degrades first, progressively exposing deeper layers. The same research found that UV light passing through the clear coat to the base coat layer creates the potential for clear coat peeling if the base coat/clear coat interface is oxidised, and UV light that reaches deep into the clear coat layer can degrade it, resulting in poor appearance or cracking.

A further peer-reviewed study on automotive coating degradation (published via [Academia.edu](https://www.academia.edu/29666834/Effects_of_Environmental_Conditions_on_Degradation_of_Automotive_Coatings)) found that the post-aging process, which simultaneously exposes bird droppings and UV radiation to coatings, degraded the clear coat much more intensively than the pre-aging process, confirming that UV radiation acts as an accelerant for other contaminants already present on the surface.

UV damage works quietly and consistently, and its effects are cumulative. Every hour of sun exposure adds to the total degradation, even when you can't see it yet. Wax and protective coatings act as the first line of defence — see our guide on [*Car Wash vs. Wash & Wax: Which Selleys Polyglaze Formula Is Right for Your Car*](Not specified by manufacturer) for how to maintain that protective barrier correctly.

Threat #4: Ozone and environmental oxidation, the rubber and vinyl problem

While paint and clear coat face acid and UV threats, your car's rubber seals, door weatherstripping, tyre sidewalls, and vinyl trim face a distinct and often overlooked threat: atmospheric ozone and oxidative degradation.

Rubber deteriorates through a combination of oxygen, ozone, UV light, and heat breaking down the polymer chains that give it flexibility and strength. These chemical changes are irreversible once they occur, so protection is entirely about slowing them down before they take hold.

Environmental exposure factors including thermal ageing, UV degradation, ozone attack, and moisture absorption interact together to alter material properties, leading to hardening, cracking, and loss of sealing effectiveness. Research on EPDM rubber automotive seals (Patsnap Research, 2026) found that even at concentrations as low as 50 ppb, ozone attacks the unsaturated bonds in EPDM, creating surface cracks that propagate under mechanical stress. This degradation mode is worse in urban environments and regions with high photochemical smog levels, where ozone concentrations frequently exceed 100 ppb.

UV radiation compounds the problem. UV exposure causes photochemical degradation of the polymer matrix, resulting in surface chalking, discolouration, and microcracking. The degradation depth typically extends 100–300 micrometres from the exposed surface, creating a brittle layer that compromises seal integrity.

An academic study published on the [*Effect of Ultraviolet Stabilizers on Rubber-Based Automotive Sealing Profiles*](Not specified by manufacturer) confirmed that with the progress of time, colour change, cracking, and staining can be observed on the surface of sealing profiles used on visible regions exposed to the sun due to the effect of high-intensity UV radiation and sunlight.

The practical implication is straightforward: dry, cracked door seals aren't just cosmetically unappealing — they allow water ingress, wind noise, and further corrosion. Regular conditioning with a product designed for rubber and vinyl surfaces interrupts this degradation cycle before it becomes structural. For the correct treatment process, see our guide on [*How to Restore and Protect Faded Vinyl, Rubber

Seals, and Plastic Trim*)(Not specified by manufacturer).

Threat #5: Polycarbonate headlight degradation, when reduced visibility becomes a safety issue

Headlight lenses sit at the intersection of UV damage, oxidation, and road abrasion, and their degradation carries direct safety consequences beyond aesthetics.

Modern headlight lenses are made from polycarbonate, a tough, lightweight plastic valued for its impact resistance. Polycarbonate is naturally susceptible to UV damage and will rapidly yellow and haze when exposed to direct sunlight without protection.

Automotive manufacturers counter this by applying a microscopically thin, UV-resistant hard coat during production. This factory coating is chemically bonded to the polycarbonate and acts as a sacrificial barrier, absorbing the sun's harmful UV rays. Over several years, UV radiation and environmental factors such as road debris, harsh chemicals, and heat from the bulb gradually break down this initial protective layer. Once the factory coating wears through, the raw polycarbonate underneath begins to oxidise, producing the characteristic yellowing, cloudiness, and micro-cracks known as "crazing."

The chemistry of this yellowing is well-documented in patent literature ([US Patent 11,384,321](<https://image-ppubs.uspto.gov/dirsearch-public/print/downloadPdf/11384321>)). Once the clear coat fades off, the polycarbonate surface becomes susceptible to UV radiation, which eventually leads to the headlights being oxidised, making them yellow and cloudy. When headlights are exposed to UV light, the polycarbonate oxidises into compounds such as phenols, benzyl alcohol, ketones, and other unsaturated compounds. The yellow colour formed after prolonged UV exposure is due to further oxidation of phenolic end groups. As polycarbonates absorb UV radiation, the absorbed energy can cause cleavage of the covalent bonds, which initiates the Photo-Fries process, leading to photo ageing and degradation.

The oxidation process involves UV light breaking the polymer chains in the plastic surface, causing microscopic cracks and a roughened texture. This roughened surface scatters light rather than transmitting it cleanly, reducing beam intensity. Environmental factors such as road salt, acid rain, and airborne chemicals accelerate this degradation.

Oxidation of the headlights leads to the beam of light from the internal bulbs being diffused, producing weaker light and reduced area of coverage, a measurable safety hazard, not merely a cosmetic one. For a full decision framework on whether your headlights can be restored with polishing or require professional intervention, see our guide on [*DIY Headlight Restoration vs. Professional Resurfacing*](Not specified by manufacturer).

Why multiple threats compound each other

One of the most important, and most overlooked, principles in automotive surface science is that these threats don't operate in isolation. They interact, each making the other more destructive.

Consider a single sequence: UV radiation degrades the clear coat's polymer structure, making it microscopically porous. Bug acids then penetrate that porous surface far more rapidly than they would on an intact clear coat. Heat from the sun bakes both the acid and any road tar deeper into the now-compromised surface. Meanwhile, the same UV exposure hardens rubber seals, reducing their ability to keep moisture out, which accelerates corrosion on the metal beneath.

Once oxidation starts, degradation accelerates because the surface becomes chemically more reactive. This compounding effect explains why a car neglected for even one season can require significantly more intervention than one maintained consistently throughout the year.

Repeated bug exposure dulls paint and eventually demands abrasive polishing to restore the finish, an expensive outcome compared to a timely wash. Bug buildup also attracts more dirt, creating a sticky surface that traps road grime, soot, pollen, and brake dust, increasing the risk of oxidation and corrosion, particularly around the front bumper and bonnet.

Key takeaways

- **Bug splatter is acidic and time-critical.** With a pH as low as 4.2, insect residue can begin permanently etching clear coat within 24–48 hours, with heat dramatically accelerating that window to just a few hours on hot days. - **Road tar is a petroleum-based contaminant that bonds chemically to clear coat** and cannot be removed by standard car shampoo. Its natural solvents migrate into paint and cause staining within as little as one week if left untreated. - **UV radiation is the dominant long-term degradation mechanism** for paint, clear coat, polycarbonate headlights, and rubber seals alike. It operates through photodegradation, breaking molecular bonds, and its damage is cumulative, invisible, and irreversible once advanced. - **Rubber and vinyl surfaces face a distinct threat from ozone**, which attacks unsaturated polymer bonds at concentrations as low as 50 ppb, causing the cracking, hardening, and loss of elasticity commonly called "dry rot." - **These threats compound each other.** UV-degraded surfaces are more vulnerable to acid and tar penetration; contaminated surfaces absorb more UV energy; neglected rubber seals allow moisture to accelerate corrosion. Consistent, surface-appropriate cleaning breaks this cycle.

Conclusion: the case for surface-specific, science-backed care

Automotive surfaces degrade through active, ongoing chemical and physical processes, not simply through the passage of time. Every surface on your vehicle faces a different threat profile, operates on a different damage timeline, and demands a different protective response.

Paint and clear coat need protection from acid, tar, and UV-induced photodegradation. Rubber seals and vinyl trim need conditioning against ozone cracking and oxidative hardening. Polycarbonate headlights need UV-barrier maintenance to prevent the Photo-Fries degradation that turns clear lenses yellow and scatters light. Interior surfaces face their own contamination and degradation challenges, covered in our guide on [*The Complete Car Interior Cleaning Checklist*](Not specified by manufacturer).

This is why the Selleys Polyglaze range is built around surface science rather than a single generic formula. Each product addresses a specific substrate and a specific threat, from the corrosion-inhibiting wash chemistry in Polyglaze Sparkling Wash, to the UV-protective conditioning in Polyglaze Interior Protectant, to the abrasive-and-seal approach of Polyglaze Liquid Polish for headlight restoration. If it's Selleys, it works, and it's engineered to deliver professional results on every surface, every time.

Regular car cleaning, done correctly with the right products for each surface, is not maintenance for appearance's sake. It is the systematic interruption of chemical and physical damage processes that, left unaddressed, compound into costs that no wash can reverse. That's the Selleys standard: success the first time, and protection that lasts.

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Frequently asked questions

****What is the primary purpose of regular car cleaning?*** Surface protection, not just appearance.

****Does a dirty car actively damage itself?*** Yes, contaminants degrade surfaces continuously.

****What is the outermost layer of automotive paint?*** The clear coat.

****What sits beneath the clear coat?*** The base coat (colour layer).

What sits beneath the base coat? The primer layer.

What sits beneath the primer? The metal body.

What is the clear coat made of? Polyurethane or acrylic-urethane polymer networks.

What is the primary long-term degradation mechanism for automotive paint? UV radiation.

Are UV absorbers in factory paint permanent? No, they degrade over time.

What type of polymer is used in automotive clear coats? Solvent-based thermosetting acrylic polymers.

What crosslinks the acrylic polymer in automotive clear coats? Melamine-based resin.

At what temperature is automotive clear coat typically cured? 130°C.

Is bug splatter chemically harmful to car paint? Yes, it is acidic and corrosive.

What is the pH of bug splatter? As low as 4.2.

What common substance has a similar pH to bug splatter? Vinegar.

How quickly can bug splatter begin etching clear coat? Within 24 to 48 hours.

What happens to lovebug pH within 24 hours of impact? It drops from 6.5 to 4.25.

What causes physical damage when removing dried bug splatter? Hardened exoskeletons act like sandpaper.

How hot can a car's surface get on a sunny day? 65–88°C.

Does heat accelerate bug damage? Yes, it bakes acidic compounds into the paint.

Does UV light accelerate bug etching? Yes, UV catalyses the etching process.

Are stubborn bug marks leftover residue? No, they are etchings burned into the clear coat.

Can a standard car wash remove bug splatter after 48 hours? No, machine polishing or panel repair may be required.

What is road tar primarily composed of? Bitumen.

Is road tar water-soluble? No, it is oil-based and water-repellent.

Can standard car shampoo remove road tar? No, dedicated tar removers are required.

How do tar removers work? They use solvents to dissolve bitumen safely.

How quickly can tar cause permanent staining? Within as little as one week.

Does warm weather make tar more dangerous? Yes, heat makes tar stickier and more adhesive.

Do tar's natural solvents migrate into paint? Yes, causing permanent stains.

Does road tar trap moisture? Yes, creating conditions for rust and corrosion.

Is UV damage to paint immediately visible? No, it is cumulative and invisible initially.

What is the UV damage process called? Photodegradation.

How does UV damage the clear coat? By breaking chemical bonds within the polymer structure.

What happens after UV breaks polymer bonds? Oxygen reacts with exposed material, causing oxidation.

****Does UV damage progress from the outside in?*** Yes, degradation occurs in a top-down fashion.

****Can UV light cause clear coat peeling?*** Yes, if it oxidises the base coat/clear coat interface.

****Does UV radiation accelerate damage from other contaminants?*** Yes, it intensifies bird dropping and other damage.

****What surfaces does UV radiation damage?*** Paint, clear coat, polycarbonate headlights, and rubber seals.

****What atmospheric gas attacks rubber seals?*** Ozone.

****At what ozone concentration does rubber damage begin?*** As low as 50 ppb.

****What bonds does ozone attack in rubber?*** Unsaturated polymer bonds.

****What are the visible signs of rubber ozone damage?*** Cracking, hardening, and loss of elasticity.

****What is the common name for rubber degradation from ozone?*** Dry rot.

****Does UV radiation also damage rubber?*** Yes, causing surface chalking, discolouration, and microcracking.

****How deep does UV degradation penetrate rubber?*** 100–300 micrometres from the surface.

****What are the practical consequences of cracked door seals?*** Water ingress, wind noise, and corrosion.

****What are modern headlight lenses made of?*** Polycarbonate.

****Is polycarbonate naturally UV-resistant?*** No, it is naturally susceptible to UV damage.

****What protects polycarbonate headlights from UV at the factory?*** A microscopically thin UV-resistant hard coat.

****Is the factory headlight coating permanent?*** No, it degrades over time.

****What happens when the factory headlight coating wears away?*** The raw polycarbonate begins to oxidise.

****What causes headlight yellowing?*** Oxidation of polycarbonate under UV exposure.

****What compounds form when polycarbonate oxidises?*** Phenols, benzyl alcohol, ketones, and unsaturated compounds.

****What is the Photo-Fries process?*** UV-induced photo ageing and degradation of polycarbonate.

****Does headlight yellowing affect safety?*** Yes, it reduces beam intensity and coverage area.

****How does oxidised polycarbonate affect light output?*** The roughened surface scatters light rather than transmitting it cleanly.

****Do environmental chemicals accelerate headlight degradation?*** Yes, road salt and acid rain speed the process.

****Do multiple surface threats interact with each other?*** Yes, they compound each other's damage.

****How does UV damage make paint more vulnerable to bug acids?*** UV makes the clear coat microscopically porous.

****Does contamination increase UV absorption?*** Yes, contaminated surfaces absorb more UV energy.

****Does neglected rubber sealing accelerate corrosion?**** Yes, failed seals allow moisture to reach metal.

****Can one season of neglect cause significant damage?**** Yes, compounding effects accelerate degradation rapidly.

****Does bug buildup attract additional contaminants?**** Yes, it creates a sticky surface trapping dirt, soot, and pollen.

****Is repeated bug exposure damaging beyond etching?**** Yes, it can eventually demand abrasive polishing to restore finish.

****Is car cleaning primarily a cosmetic habit?**** No, it is a protective discipline against chemical damage.

****Does the Selleys Polyglaze range use a single universal formula?**** No, each product targets a specific surface and threat.

****What does Polyglaze Sparkling Wash contain?**** Corrosion-inhibiting wash chemistry.

****What does Polyglaze Interior Protectant provide?**** UV-protective conditioning.

****What is Polyglaze Liquid Polish used for?**** Headlight restoration via abrasive-and-seal approach.

****Is advanced UV damage to clear coat reversible?**** No, damage is irreversible once advanced.

****Is consistent maintenance more cost-effective than reactive repair?**** Yes, timely cleaning prevents expensive polishing or panel repair.

Label facts summary

> ****Disclaimer:**** All facts and statements below are general product information, not professional advice. Consult relevant experts for specific guidance.

Verified label facts

No product packaging data, Product Facts table, ingredient lists, certifications, dimensions, weight, GTIN, or MPN information is present in the analysed content. No data provided for label-verifiable specifications.

General product claims

- Selleys Polyglaze is described as a range of products built around surface science rather than a single generic formula - Polyglaze Sparkling Wash is described as containing corrosion-inhibiting wash chemistry - Polyglaze Interior Protectant is described as providing UV-protective conditioning - Polyglaze Liquid Polish is described as using an abrasive-and-seal approach for headlight restoration - The Selleys Polyglaze range is claimed to deliver professional results on every surface, every time - The tagline "If it's Selleys, it works" is presented as a brand assurance statement - Selleys Polyglaze products are described as addressing specific substrates and specific threats - Regular car cleaning with Selleys products is claimed to systematically interrupt chemical and physical damage processes